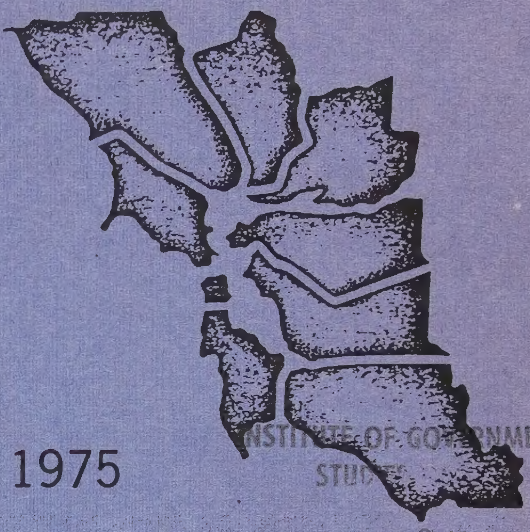
SAN FRANCISCO BAY REGION
WASTEWATER MANAGEMENT FACILITIES

PROJECT COORDINATION PROGRAM



REPORT – JULY 1975
FOR

bassa

BAY AREA SEWAGE SERVICES AGENCY
CLAREMONT HOTEL, BERKELEY, CALIFORNIA

J.B. GILBERT AND ASSOCIATES
SACRAMENTO AND BERKELEY

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CLAREMONT HOTEL, BERKELEY, CALIFORNIA

water quality management -- CA --
SF metro area
Sewage disposal plants -- CA --
SF metro area.

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August 13, 1975

Mr. Paul Soltow
Mr. Dan Murphy
Bay Area Sewage Services Agency
Claremont Hotel
Berkeley, California 94705

Gentlemen:

This report describes our work as part of BASSA's Project Coordination Program. We have analyzed the schedules of all BASSA-area, grant-funded, pollution control projects. In addition, we have estimated the water quality effects of the projects. Existing and anticipated implementation problems have been identified, and we have recommended actions to be taken to ameliorate these problems.

Our general conclusion is that the $1.5 billion water pollution abatement program now in progress for the San Francisco Bay Area is in need of more centralized, regional coordination if not management. Otherwise, the existing problems are likely to persist and additional problems will occur. These problems will lead to delays in achievement of desired water quality or increased cost to the public or both.

We appreciate the assistance of you and your staff on this interesting study.

Very truly yours,

J. B. GILBERT & ASSOCIATES

Howard J. Naftzger W. J. Miller

Howard J. Naftzger — Project Engineer
William J. Miller — Project Manager

ACKNOWLEDGMENTS

We wish to acknowledge the assistance of BASSA staff members Paul Soltow, Karol Enferadi, Peter Chiu, Keith Halvorson, and, especially, Dan Murphy throughout the study, particularly with data collection.

J. B. Gilbert & Associates staff who worked on this project include:

William J. Miller	General Direction
Howard J. Naftzger	Project Direction & Report Preparation
John Monser	Water Quality Analyses
Jane Powers	Schedule Analyses
Robert Crandall	Graphics
M. A. Tolmasoff	Report Preparation

We would like to acknowledge the assistance of Mr. Warren Uhte, who acted as a special consultant in the analysis of construction schedules and problems.

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CHAPTER 1

INTRODUCTION

NATURE OF THE PROBLEM

In the nine-county San Francisco Bay Area there are around seventy-five public agencies operating sewage collection and treatment facilities and discharging more or less treated waste. Most of this waste eventually reaches San Francisco Bay, California's largest and most important estuary. In addition, a number of smaller communities are served by septic tank systems.

To improve water quality in the bay and other surface and ground water bodies, a massive construction program for wastewater management facilities is under way. Over $1.5 billion, the major part of it in federal grants, will be spent or committed by the end of 1981. Approximately eighty-five projects are currently either under construction or in the planning or design stage. However, this program lacks something of being a unified effort because of the large number of local jurisdictions noted above and because overview responsibility is divided among several federal, state, and regional agencies, as follows:

- The Environmental Protection Agency is responsible for reviewing and awarding grants and for assessing environmental impacts. It may choose to conduct environmental impact studies independent from those conducted for state agencies. As well as administering the requirements of PL 92-500 (Federal Water Pollution Control Act Amendments of 1972), EPA is charged with administering some thirty other environmentally-oriented laws.

- The State Water Resources Control Board also has grant and environmental impact responsibilities. A portion of grant funding is state money; up to 87½ percent of a given project may be funded from state and federal sources. The major effort in both grant and environmental impact review is typically, in California, delegated by EPA to the State Board.

- The Regional Water Quality Control Boards are agencies of the state government. Their responsibilities involve setting the requirements for improvements in the quality of waste discharges and the schedules that must be met in effecting

these improvements. Although the San Francisco Bay Regional Board has responsibility for most of the Bay Area, three other Regional Boards administer portions of the nine-county area of this study.

- The Bay Area Sewage Services Agency is a regional public body made up of the local agencies which collect, treat, and discharge sewage in the San Francisco Bay Area. To carry out its responsibility of assuring expeditious implementation of wastewater management programs, BASSA is primarily involved in coordination and planning activities; but where it is required, BASSA also has authority for project implementation.

BASSA REGIONAL SERVICES PROGRAM

This study and report have been undertaken as part of the Bay Area Sewage Service Agency's Regional Services Program. The overall program is designed to help local, subregional, and regulatory agencies plan, implement, and operate facilities in order to achieve an effective regional water quality management system.

The study is part of the Project Coordination Program.

PURPOSES OF THE STUDY

The main effort of this study has been

- to compile information needed to coordinate the management of wastewater facilities.
- to analyze this information to determine where, how, and what kind of problems may develop and what the impact of the program on water quality in the bay will be.
- to develop recommendations for avoiding or minimizing the problems identified and for enhancing the efficiency and beneficial impacts of the program.

It is intended that the study be used

- to provide regulating and implementing agencies with a basis for developing coordinated management.

- to establish a basis for a program to track individual projects.

- to provide information for resolving problems at the earliest possible date.

CRITICAL PATH CHART

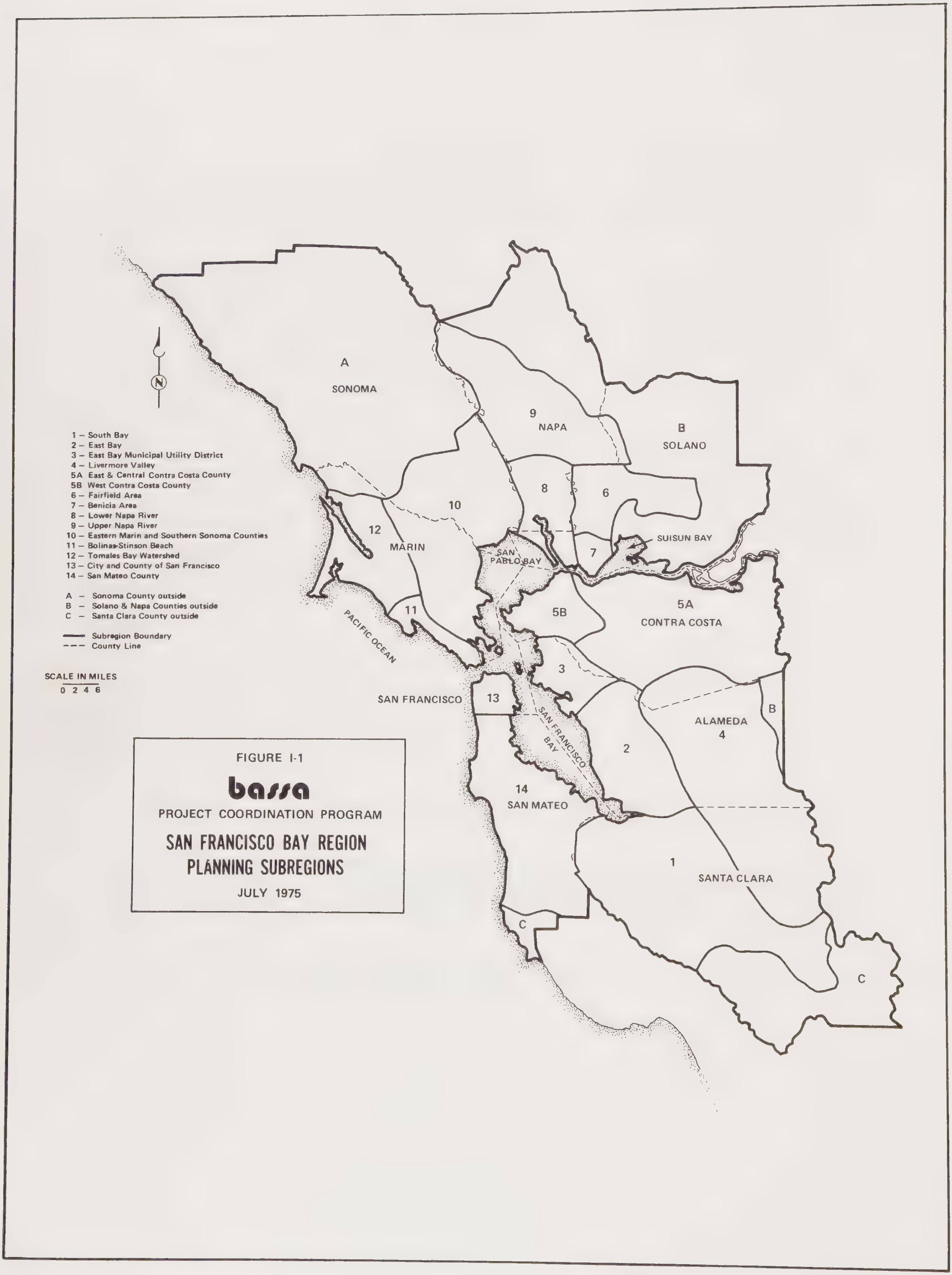
The possibility of preparing a critical path chart for the entire grant-funded program was considered early in this study. However, a critical path schedule consists of a network of related activities comprising essentially a single project. The grant-funded program consists of more than eighty individual projects, most of them quite unrelated to one another. Thus, it is impossible to prepare a single critical path schedule for the entire program.

UPDATING SCHEDULE DATA

Scheduling data has been compiled and published as Appendix A of this report. Appendix A and a general approach to updating it are described in Chapter III of this report. Details of updating procedures have been transmitted to BASSA in the form of working documents.

AREA OF STUDY

The area covered by this study is the full nine-county BASSA region. For convenience, this region has been divided into a number of subregions. The BASSA area and its subregions are shown on Figure I-1.



1 – South Bay
2 – East Bay
3 – East Bay Municipal Utility District
4 – Livermore Valley
5A East & Central Contra Costa County
5B West Contra Costa County
6 – Fairfield Area
7 – Benicia Area
8 – Lower Napa River
9 – Upper Napa River
10 – Eastern Marin and Southern Sonoma Counties
11 – Bolinas-Stinson Beach
12 – Tomales Bay Watershed
13 – City and County of San Francisco
14 – San Mateo County
A – Sonoma County outside
B – Solano & Napa Counties outside
C – Santa Clara County outside
Subregion Boundary
County Line
SCALE IN MILES
0 2 4 6
N
A
SONOMA
9
NAPA
B
SOLANO
8
6
10
12
MARIN
SUISUN BAY
7
SAN PABLO BAY
5B
5A
CONTRA COSTA
11
PACIFIC OCEAN
3
SAN FRANCISCO
13
B
ALAMEDA
4
SAN FRANCISCO BAY
2
14
SAN MATEO
1
SANTA CLARA
C
C
FIGURE I-1
bassa
PROJECT COORDINATION PROGRAM
SAN FRANCISCO BAY REGION
PLANNING SUBREGIONS
JULY 1975

CHAPTER II

SUMMARY AND CONCLUSIONS

SCHEDULE STUDIES

Latest available scheduling and cost information on all projects in the Bay Area grant-funded wastewater management facilities program was assembled. Using this information, a project implementation schedule in the form of a bar-chart was prepared for each project. These charts are published separately as Appendix A.

Various analyses were performed using this schedule data. Cash flows for engineering and construction activities, project review work loads, bid date schedules, compliance date overruns, and a project construction schedule analysis were obtained. These are presented and discussed in Chapter III.

The major conclusions from the schedule studies are as follows:

1. The peak rate for engineering activity for the program will come in early 1976. Some staffing problems may be encountered for a few months in early 1976.

2. The State Board Grants Section is presently able to meet the review work load and should be able to continue to do so.

3. The rate of construction activity is expected to peak at about $30 million per month in 1978. The construction industry will very probably be able to absorb the peak construction rate with little strain.

4. Delivery schedules on major equipment are always long, but excessive delays are not anticipated. Pre-purchase of equipment may be indicated in some cases.

5. Pipeline construction is expected to peak rather sharply. There may be competition for larger pumping units, possibly leading to delays.

6. Shortages of labor and common materials are not anticipated. However, it would be advisable to monitor these markets periodically.

7. Clustering of several bid dates into a short time period can lead to a reduced number of bids submitted and, thus, to higher bids. Monitoring of project schedules and management of bid dates to avoid conflicts is recommended.

8. A number of jobs now face overruns of NPDES compliance dates, and the list may grow. The use of compliance dates to stimulate progress toward implementation should be handled with sensitivity by the regulatory agencies.

9. Around 20 percent of the projects have allotted construction times that may be unrealistically short. It is recommended that schedules for these projects be reviewed. For most of these projects, schedule adjustments could be made with little adverse consequence if so indicated.

10. Schedule changes and delays can have impacts on water quality, can create or reduce competition between projects for services and materials, and can even alter the economic climate of the whole program. Monitoring of progress of jobs and updating of schedule information can provide the data to predict and deal with these effects.

WATER QUALITY

The effect on the water quality in San Francisco Bay of the grant-funded wastewater facilities program was assessed by using mathematical model results. Several previous studies had produced predictive water quality coefficients through the use of mathematical models. These predictive coefficients were used in this study, and the resulting information is presented in Chapter IV.

The major conclusions on water quality are as follows:

1. Projects in the South Bay are the most critical. Those south of Dumbarton Bridge are the most critical in the South Bay.

2. Water quality problems in areas of the bay north of the Richmond Bridge do not appear to exist, although there may be very local effects at discrete discharge locations.

3. South of Dumbarton Bridge, treatment to the level of the NPDES permits appears to improve dissolved oxygen values

to the required levels. However, this conclusion should be viewed with some caution because a number of factors have not been included in these analyses.

4. The removal of discharges from south of Dumbarton Bridge will reduce the bay's maximum wastewater percentage from 47 percent to 7 percent. The potential problems in the South Bay, which could result from high wastewater concentrations, will be largely alleviated.

5. The impact in 1980 of relocating the primary discharge of San Francisco's North Point Plant to the Southeast location is very evident. The resulting concentration peak seems well below any limiting level, however.

Public Law 92-500 is the major impetus behind the grant-funded facilities program, both in the Bay Area and nationally. In accordance with the water quality requirements of the act, the Environmental Protection Agency has set a minimum interim standard for all dischargers of 85 percent removal of BOD (secondary treatment). It would appear from the results of analyses in this study that this is the governing requirement for many of the projects in the program, as opposed to alleviation of specific receiving water problems.

PROBLEMS AND PROBLEM SOLUTIONS

The complexity and diversity of the $1.5 billion grant-funded wastewater management program in the Bay Area guarantee that problems will occur. Chapter V describes the problem areas that have been identified and recommends means of dealing with them.

Major conclusions are as follows:

1. The types of potential problems are varied. All types identified are significant in terms of value of projects involved. The most significant problem areas in terms of dollars are adverse public reaction and scheduling problems.

2. Public agencies can take a variety of effective actions in dealing with problem areas.

3. There is a significant role for BASSA in problem solution. It will require aggressive action, especially in the area

of scheduling, including the coordination of bid dates, the establishment of realistic schedules, and the reconciliation of reasonable schedules with NPDES permit compliance schedules where the two differ.

CHAPTER III

PROGRAM SCHEDULE STUDIES

PROJECT IMPLEMENTATION SCHEDULES

Scheduling information has been collected for all currently active projects in the grant-funded wastewater management facilities construction program in the San Francisco Bay Area. Data-gathering has been done primarily by BASSA staff. Data sources include local discharger agencies and their consultants and, to a lesser degree, the Regional Water Quality Control Boards and the State Water Resources Control Board.

Information was typically used as given, except where obvious discrepancies called for re-checking. Schedules and construction costs are estimates and, particularly for jobs in the planning stage, quite subject to change. Thus, for many jobs there is a significant degree of uncertainty in the data. In the overall picture, however, the largest single job represents about 8 percent of the anticipated area-wide expenditure, and only a handful of jobs are more than 3 percent of the total. Therefore, changes in data for a few jobs may be important of themselves, but are not too significant as far as the entire program is concerned.

A project implementation schedule was prepared for each project for the data available through June 20 of this year. These schedules have been compiled as Appendix A of this report. The schedules in Appendix A are grouped according to the subregions delineated on Figure I-1.

Carrying a wastewater management project from conception through to implementation is a very complex process. In this study, it was distilled into the rather concise format adopted for the project implementation schedules. For a typical project, seven major activities were identified:

- Negotiation of necessary institutional arrangements
- Preparation of Project Report and Environmental Impact Report
- Preparation of Environmental Impact Statement (federal requirement)

. Arrangement for local share of funding

. Acquisition of necessary real estate

. Preparation of plans and specifications

. Bidding and construction

Not all activities are applicable for every project. In a few cases an additional category was required. Although the EIS process, like the Project Report and EIR, is part of the planning process, it was taken as a separate activity because it was found to frequently have a life and schedule of its own.

The projected implementation schedules have been prepared with time as the abcissa. Activities, which consume time, are shown as horizontal bars, each occupying its appropriate span. Any of the activities can be subdivided in time (for instance, into preparation and review). Along with activities, a number of events (landmarks in time) were also identified. These were of several types: submissions, completions, approvals, elections, and deadlines. Estimated dates for these events are shown on the schedules by a series of symbols.

Appendix A is intended to be a working document. Pages can be added as required for new projects. The implementation schedule format was laid out to be used by BASSA staff for following the progress of projects, using appropriate marks and notations. The schedules in Appendix A prepared as part of this study should be updated on a regular basis as newer data become available.

It should be emphasized that this study has been restricted to grant-funded wastewater management facilities. In addition to the projects included here are projects undertaken by local public entities entirely with local funds and projects undertaken by industrial dischargers. It is believed, however, that the greatest part of the total activity in new wastewater management facilities in the Bay Region is included in this study.

DESCRIPTION OF ANALYSES AND DISCUSSION

Engineering Activities

From the data, anticipated cash flows for planning and for design work were developed. From these, a curve showing estimated

requirements for engineering office personnel was obtained. These plots are shown on Figure III-1. Notes pertaining to each figure describe the analyses in more detail.

The analyses indicate that the activity in planning in the Bay Area grant-funded program is currently about $900,000 per month (a peak). This rate will drop off to half of that by the end of the year and to near zero by the end of 1976. Current activity in design is about $1.5 million per month. This rate is expected to increase abruptly to nearly $4 million per month for a few months in early 1976. It is expected to fall off gradually in 1976, rapidly in mid-1977, and then to remain at a level below $500,000 per month.

The plot for required engineering and technical personnel, derived from the cash flows, indicates that 600-700 people will be needed through most of 1975 in offices involved in planning or designing wastewater management facilities. Allowing for some non-grant funded projects, this figure agrees with an estimate of 700-750 people actually employed in Bay Area firms having this capability. This estimate was obtained from a telephone survey of about twenty of the largest firms.

The personnel requirement plot shows a peak demand for 1250-1300 people for about four months in early 1976, with a twelve-month average from late 1975 to late 1976 of about 1050-1100 people. The telephone survey of Bay Area offices suggested that plans exist to staff up to 900-1000 people within a year or so. This level is somewhat short of the projected requirement, but there are several factors that should help alleviate any staffing problem:

- The wastewater facilities program in the Bay Area and, hence, the projected work load in Bay Area offices will be, relative to population, considerably larger than in most other areas. (45 to 50 percent of grant money in California will go to the nine Bay Area counties.) This will facilitate recruitment of additional staff from outside tha Bay Area or will otherwise attract this staff.

- A number of the larger firms have offices elsewhere or have large multidisciplinary operations here. This would facilitate transfer or import of employees to work on this program.

- A number of fields of construction and, hence, of engineering will probably not be experiencing the peak that will occur

in wastewater facilities. Thus some types of design work (e.g., structural, mechanical) can be farmed out to other types of engineering offices that are not so heavily loaded.

Project Review

The major project review processes at both the planning and design stages are conducted by the Grants Section of the State Water Resources Control Board. Anticipated work loads for project review at the state level (as required by the Bay Area's grant-funded wastewater facilities program) are shown on Figure III-2. Work loads are shown for reviews during planning and design stages in terms of the value of construction in the review process at any given time.

The figure shows that the planning level review work load is high now--over $250 million. It is projected to remain at about that level through this year. In 1976, the load will fall off to about $150 million in review at any one time; after 1976, there will be an occasional single project.

The design level review work load is projected to be low in the second half of 1975. It will peak in mid-1976, drop off again, and then reach its highest peak of over $250 million in latter 1977. After 1977, the work load will be sporadic.

There is a major segment of the State Board's work load, covering all of California outside the Bay Area, which is outside the scope of this study. However, as has been noted, the Bay Area grant-funded program will constitute perhaps 50 percent of the total California program. Thus, the impact of the Bay Area projects on the review process is of great significance.

It is understood that around the beginning of 1975, the State Board review staff had some difficulty keeping up with the planning review load. Since then, the staff has been expanded and there seem to be no problems now.

As far as the Bay Area program is concerned, the planning review work load and total work load are as high or higher now than they will be at any time in the future. The work load is being met now; the State Board staff should be able to meet it in the future--barring distortions stemming from the non-Bay Area half of the load. It will be necessary for the Board to shift personnel appropriately from the planning review to the design review process.

Construction Cash Flow

Anticipated cash flows for construction of Bay Area grant-funded wastewater management facilities are shown on Figure III-3. Plots of cash flow for treatment plant and pipeline construction are given, as well as a plot for total construction. A plot of cash flow for total engineering activity is also given.

It is anticipated that total construction activity in this program will reach a peak of $30 million per month during the second quarter of 1978. For all of 1978, the average rate is projected to be about $28 million per month, which translates into a requirement for an estimated 2500-3000 construction workers of all types. Because of the closely enforced specialization in the building trades, it would be necessary to break the total work force down into craft categories, job by job, in order to check possible problems of labor availability. An analysis in this detail is beyond the scope of this study. Compared with the estimated peak work force of 2500-3000 for this program the total membership in craft unions in San Francisco alone (but including many crafts not applicable here) is 13,000.

In the construction industry, craftsmen typically move from place to place following jobs. Coupled with this fact is the expectation, previously noted, that the rate of activity in wastewater facility construction in the Bay Area will be uniquely high. Thus, recruitment of additional personnel, where required, should not be difficult.

Projections are that treatment plant construction will proceed at a fairly uniform rate of $11 to $14 million per month from 1976 through 1978, and will then drop off gradually. Larger treatment plants require major equipment made to order in specialized plants. The rather steady rate of construction should ease competition for major equipment and thus reduce the chance of delays from long or late deliveries.

Pipeline construction is projected to peak more sharply, with an average rate in 1978 of about $16 million per month. The rate will climb fairly steeply to that figure and fall off fairly rapidly after 1978. This peak in pipeline activity is the major reason for the anticipated peak in the overall construction rate. This peak can probably be absorbed fairly readily: pipelaying is less specialized than treatment plant work and can draw on a greater variety of contractors. Compared with major equipment, the production of pipe is a flexible operation with

short delivery times. However, most of the larger pipeline jobs include large pump stations, and the larger pumping units do qualify as major equipment. Thus it is possible that this peaking demand, added to the requirement for pumps for treatment plant jobs, could produce a problem in delivery.

Overall, there appear to be no major problems in meeting the construction activity rates shown. Both industry capability and labor supply seem to be adequate. Competing construction programs such as BART and the highway program are largely complete. Two areas of concern, bid scheduling and major equipment deliveries, are discussed later in this chapter. It is expected that such materials as pipe, cement, and rebar will be in adequate supply. However, shortages have developed on occasion in materials markets, affecting prices and delivery. A monitoring program for equipment and materials availability could usefully be instituted.

Bid Dates

The number of contractors able to bid on the large jobs is limited. When several large jobs are to be bid in close sequence, even large contractors must make a choice as to which job to bid because of the effort required in preparing a bid; or must skimp on bid preparation time. Either of these will likely result in higher bids, either through reduced competition or through padded contingency factors. Plots of estimated project costs vs. anticipated bid dates are given on Figure III-4 for pipeline and for treatment plant construction. These plots, based on presently available schedules, show considerable undesirable clustering of major bid dates, especially for pipeline work, but also for plant work. Table III-1 summarizes these apparent conflicts.

As can be seen in the table, the completion of only three of the jobs whose bid schedules presently appear to be in conflict will have important immediate impact on water quality. Only one other of these jobs (San Francisco West Side Transport) has a compliance schedule set by the Regional Water Quality Control Board. From the standpoints of regulatory agency scheduling and water quality impact, then, there is ample latitude to adjust bid schedules of a number of jobs to enhance the competitive nature of the bidding.

If bid schedule management is practiced, it will be necessary to review <u>all</u> job schedules, not only those in Table III-1, to avoid

producing new conflicts and to reflect the inevitable schedule changes. Although pipeline and plant jobs were treated separately in Figure III-4 and Table III-1, it should be noted that there is a clustering of both large plant and large pipeline jobs to be bid in winter 1977-8. This cluster includes the South Bay Interceptor and the San Francisco Southeast Plant. Both of these are jobs of major size and significant water quality impact. Because of their size, they may tend to draw substantially from the same list of bidders. An effort should be made to alleviate this conflict, if it exists in fact as bid time approaches.

It may be noted that the Bay Area Rapid Transit System, now approaching full operation, was a construction program of similar magnitude to the grant-funded program examined in this study and was accomplished for the most part in a similar or slightly longer time span. Two distinct advantages were enjoyed by BART:

- Because a single public body was the implementing agency, central management was practiced to schedule all work and smooth out cash flows, bid schedules, etc. to the greatest extent possible.

- Because of the nature of the work, much of the fixed construction was divided, for design, bidding, and construction, into packages of $10-15-20 million in construction costs. This enabled a greater number of contractors to bid on more of the work, enhancing competition. It is possible that this method could be used on some of the largest jobs in this program.

Compliance Schedule Conflicts

Under federal law, all entities that discharge liquid wastes to surface waters are required to obtain a permit to discharge. In California, the permit program has been delegated to the state, which administers the program through the Regional Water Quality Control Boards. The permits typically stipulate minimum water quality standards for effluent and receiving water. Many permits also set compliance schedules for meeting the water quality requirements.

In Figure III-5, a comparison is made between the final compliance date and the local agency's estimated schedule for project completion. Only those projects having firm dates set by the Regional Board are shown. Of the thirty-nine projects shown,

twenty-four (with a total estimated cost of $410 million) will be behind schedule for compliance, while fifteen (with a total cost of $240 million) are expected to be on line at or before the compliance date. However, another forty-five projects (estimated at $850 million) have not been assigned final compliance dates.

From an examination of Figure III-5, some tendencies become apparent. From a comparison of the jobs having early compliance dates with those scheduled for compliance in 1977 and beyond, it can be seen that the early jobs are more likely to be late in compliance and to have a greater margin of time overrun. This could be the result of either or both of the following factors:

- The earlier compliance dates are, perhaps, less realistically set.

- Project schedules may be overly optimistic for the early stages of a job; jobs with early compliance dates, being further advanced, will have slipped somewhat from their early schedules. If this is true, then the jobs with later compliance dates are likely to slip as well.

There is some tendency for the jobs with long anticipated overruns to be the smaller jobs. There are two possible explanations for this:

- Larger agencies, which build larger jobs, may have better capabilities for carrying projects through.

- Few of the larger jobs are in the early completion group, where most of the longer overruns occur. As the larger jobs approach completion, more long overruns may appear in this group.

As noted previously, more than half of the individual projects, constituting more than half of the project cost, do not have final compliance dates at this time. Some of these, involving solids handling, wastewater reclamation, etc., do not require discharge permits. For most of this group, however, permits have been written to require submission of schedule information to the Regional Board. Presumably, final compliance dates will ultimately be set.

A review of project schedules suggests that for larger jobs (over $20 million), the scheduled completion date is earlier for projects having a final compliance date than for those without such a date. If this correlation is real, it probably means that the pressure of a firm compliance date manifests itself in a schedule that is optimistic in anticipating compliance.

If this pressure is carried through to all the steps of implementation and ultimately results in the project's coming on line sooner than it otherwise would, then the effect is beneficial. If, on the other hand, the pressure primarily results only in unrealistic scheduling and subsequent violation of the permit, which should lead to enforcement actions by the Regional Board, the overall effect is detrimental. The net result will either be a distraction of effort by the implementing agency (in responding to enforcement actions--if they are taken) or a loss of credibility by the Regional Board (if no enforcement action is taken). The ultimate consequences of anticipated lack of compliance should be considered further by the State and Regional Boards. A realistic view of scheduling should govern application of pressure on dischargers.

Construction Scheduling Problems

A review was made of proposed construction schedules for individual projects to determine if adequate time for construction had been allowed. For a number of projects, the time schedule seemed questionably short. These projects are summarized in Table III-2.

In Table III-2, there are two columns giving approximate values for duration of the construction process, as estimated by this office. These estimates are not held out as being definitive; their inclusion here for comparative purposes is only meant to suggest that schedules for the projects in question should be reviewed critically by the agencies involved.

The first of these two construction period measures has been called "Estimated Construction Time, Cash Flow Basis"; it is simply an estimate of how long, on the average, it should take to build a project of a given size. The second measure has been called "Estimated Equipment Delivery and Installation Time," which is self-explanatory. For all jobs included in Table III-2, one or both of these measures is substantially greater than the time period presently budgeted for construction.

The "Comments" column gives suggested actions that may be taken, assuming that a review of the schedule by the discharger agency does indicate existence of a problem. NPDES compliance dates and water quality impacts are given as background material for assessing any schedule changes (water quality impacts are derived from Chapter IV).

To alleviate a problem of long anticipated delivery time on major equipment, pre-ordering by the implementing agency of such equipment prior to the time of bidding can be utilized. In Table III-2, equipment delivery and installation is the smaller of the two estimated measures of construction time for most of the jobs shown. In such cases, pre-purchasing would be of little value.

For the majority of projects shown in Table III-2, lengthening of schedules to what may be more reasonable durations would seem to pose few problems. Only two jobs in the table have important water quality impacts; both of these have the capability of being adjusted without a compliance date overrun.

Effects of Schedule Changes and Delays

A few projects in the Bay Area grant-funded program have very important water quality impacts. This is true particularly of projects affecting quality in the far South Bay. Every effort should be made to bring these projects to early completion. Unfortunately, two of these have already been delayed substantially by the timing of requirements for Environmental Impact Statements.

Most projects in the program are mandated more by the general requirements of Public Law 92-500 than by acute water quality considerations. Schedule delays for these projects thus may seem more important administratively than environmentally.

Schedule changes in one project can affect the schedules of other projects by bringing them into or out of conflict in such areas of competition as engineering services, bid dates, equipment orders, and so on. By monitoring progress of jobs and updating schedule information regularly, the creation or easing of such conflicts can be predicted at the earliest possible date.

There is a good chance that delays will occur on a number of projects and that this will have an overall effect on the entire

program. The most probable type of effect would be the flattening out of peak rates of activity for engineering, construction, etc., and the lengthening of the program to some degree. While such delays would be unfortunate from a water quality standpoint, the effect in easing cash flows and reducing competition for commodities and services might well be beneficial. Again, by monitoring job progress and updating schedule information, such effects can be predicted at an early date.

CONCLUSIONS

The major conclusions regarding scheduling of projects in the grant-funded wastewater facilities program are as follows:

1. The peak rate for engineering activity for the program will come in early 1976. Engineering offices will have to staff up from present levels to meet 1976 work loads. Some staffing problems may be encountered for a few months in early 1976.

2. Future work loads from state review of Bay Area projects at the planning and design levels will be no higher than they are at this time. The State Board Grants Section is presently able to meet the review work load and should be able to continue to do so.

3. The rate of construction activity is expected to peak at about $30 million per month in 1978. It is unlikely that there will be competing major programs in the heavy construction field. The construction industry will very probably be able to absorb the peak construction rate with little strain.

4. Delivery schedules on major equipment are always long. An anticipated fairly uniform rate of treatment plant construction over several years will help minimize competition for equipment, thus helping to avoid delays. Pre-purchase of equipment may be indicated in some cases.

5. Pipeline construction is expected to peak rather sharply. In general, this peak is not expected to create problems, with the exception that there may be competition for larger pumping units, possibly leading to delays.

6. Shortages of labor and common materials are not anticipated. However, it would be advisable to monitor these markets periodically.

7. Clustering of several bid dates into a short time period can lead to a reduced number of bids submitted and, thus, to higher bids. Present schedules indicate several such clusters may occur. Monitoring of project schedules and management of bid dates to avoid conflicts is recommended. In adjusting schedules, attention must be paid to such factors as water quality impacts and NPDES compliance dates.

8. A number of jobs now face overruns of NPDES compliance dates, and the list may grow. On the other hand, the number of jobs having critical water quality impact is quite limited. The use of compliance dates to stimulate progress toward implementation should be handled with sensitivity by the regulatory agencies.

9. Around 20 percent of the projects have allotted construction times that may be unrealistically short. It is recommended that schedules for these projects be reviewed. For most of these projects, schedule adjustments could be made with little adverse consequence if so indicated.

10. Schedule changes and delays can have impacts on water quality, can create or reduce competition between projects for services and materials, and can even alter the economic climate of the whole program. Monitoring of progress of jobs and updating of schedule information can provide the data to predict and deal with these effects.

NOTES ON DEVELOPMENT OF SCHEDULE FIGURES

General

These analyses were developed from the data shown on the project implementation schedules (Appendix A). All data available by June 20, 1975, have been included. Certain projects shown on the individual schedule sheets as being "indefinite," but which are considered viable, have been included in this summary on the basis of assumed completion schedules. A few projects appeared so indefinite that they were excluded.

Cash flow plots for the entire Bay Area grant-funded program were prepared as the sum of individual cash flows; for the latter, a uniform expenditure rate was assumed over the projected duration of the activity in question.

All cost information is based on the estimated construction costs shown on the implementation schedules. These estimated costs have been obtained from various sources, including discharger agencies and their consultants and the State Water Resources Control Board's current project list. The estimated costs are intended to be in 1974-75 dollars (ENR Index=2300-2500). It should be understood, however, that many of the estimates are rather tentative, especially for projects still in the conceptual stage. Equally, the schedules shown are subject to revision and, in fact, should be regularly updated as new information becomes available. These uncertainties should be kept in mind by readers of this report.

Figure III-1:

Cash flows are shown for the engineering activities under the headings "Planning" (project reports, overview facilities reports, environmental impact reports and statements) and "Design" (design of facilities, preparation of plans and specifications, supporting field work). Value of planning and design work was obtained from estimated construction costs through application of A.S.C.E. recommended fee curves plus professional judgement.

The plot of estimated required number of engineering personnel was obtained from the cash flows for planning and design, using the following average hourly billing rates: planning, $27; design, $20. An average billable working month was taken to consist of 160 hours.

Figure III-2:

Anticipated planning and design review periods for all grant-funded projects in the BASSA nine-county area, as shown in the project implementation schedules, have been integrated and compiled into this diagram. This figure is intended to show the load on the state-level review processes produced by the Bay Area grant-funded sewerage facilities construction program.

Figure III-3:

Cash flow plots have been developed for pipeline construction and for plant construction, considered separately, as well as for total construction activity. In many cases, a single project embraces both plant and pipeline work. In these cases, the construction cost has been divided among the two types of activity.

The engineering cash flow shown covers all planning and design activity and is the total of the cash flows for planning and design shown on Figure III-1. Field supervision during construction is not included.

Figure III-4:

Estimated construction costs have been plotted against projected bid dates, on a monthly basis. Pipeline and treatment plant jobs are shown separately. Where a project will involve significant amounts of both types of activity, the estimated cost has been divided between plant and pipeline plots. Some projects shown here as single contracts, notably the Marin County and East and West Contra Costa County subregional systems, will probably go to bid ultimately as several smaller contracts.

A number in parenthesis at the top of a bar, thus: (2), indicates the number of jobs to be bid that month. A number within a bar is used to identify the larger jobs. The list of project code numbers appears following the notes for Figure III-5.

Figure III-5:

The heavy stepped line represents all firm, final NPDES compliance dates for Bay Area projects, arranged in sequential order. For each project, the completion date according to the discharger's

schedule is also plotted, and a bar formed between the two dates. A shaded bar shows a project failing to meet the NPDES schedule; a project with a clear bar is ahead of schedule. Length of bar indicates underrun or overrun.

The numbers at the left margin are project code numbers, listed below. Numbers in the body of the graph are estimated construction costs in millions of dollars.

Project Code Numbers for Figures III-4 and III-5:

(Note: these are page numbers of project implementation schedules in Appendix A.)

1.01 South Bay Dischargers Interceptor
1.02 San Jose/Santa Clara Plant
1.04 Palo Alto Plant
1.08 Alviso Interceptor
2.01 East Bay Dischargers Interceptor
2.02 Union S. D. Plant and Force Main
2.03 San Leandro, Hayward, Oro Loma Plant
3.01 EBMUD Plant
3.02 EBMUD Wet Weather Plant (assumed schedule)
3.05 EBMUD Dechlorination Facility
4.03 Livermore Plant
4.04 Livermore Valley Effluent Disposal
5.01 East Contra Costa Subregional System
5.02 Concord Interceptor
5.03 Central Contra Costa S. D. Plant
5.06.1 Contra Costa C.S.D. No. 15 - Collection System
5.06.2 Contra Costa C.S.D. No. 15 - Plant
5.07 Central Contra Costs S.D. - Solids
5.51 West Contra Costa Subregional System (assumed schedule)
5.53 Crockett-Valona, C&H Plant
6.01 Fairfield-Suisun Interceptors, Plant
8.01 Vallejo, Mare Island Interceptor, Plant
8.02 Napa Plant
9.01 Calistoga Plant
9.02 Yountville Land Disposal
10.01 Marin County Subregional System
10.03 Glen Ellen Collection System
10.04 Penngrove Collection, Force Main
11.02 Stinson Beach Facilities
13.03 S.F. Southeast Plant
13.06 S.F. North Point to Southeast Transport

13.07	S.F. North Shore Outfall Consolidation
13.08	S.F. West Side Transport
13.12	S.F. Ocean Outfall Phase II
13.14	S.F. Southwest Plant
13.15	S.F. Crosstown Tunnel
13.16	S.F. Shoreline Storage
14.01	Millbrae et al Interceptor, Plant
14.05	North San Mateo C.S.D. Plant
A.01	Santa Rosa Plant
A.02	Santa Rosa Llano Interceptor
A.03	Rohnert Park, Cotati Interceptor
A.08	Cloverdale Plant
B.01	Vacaville Plant
B.02	Rio Vista Plant
C.01	Morgan Hill, Gilroy Plant

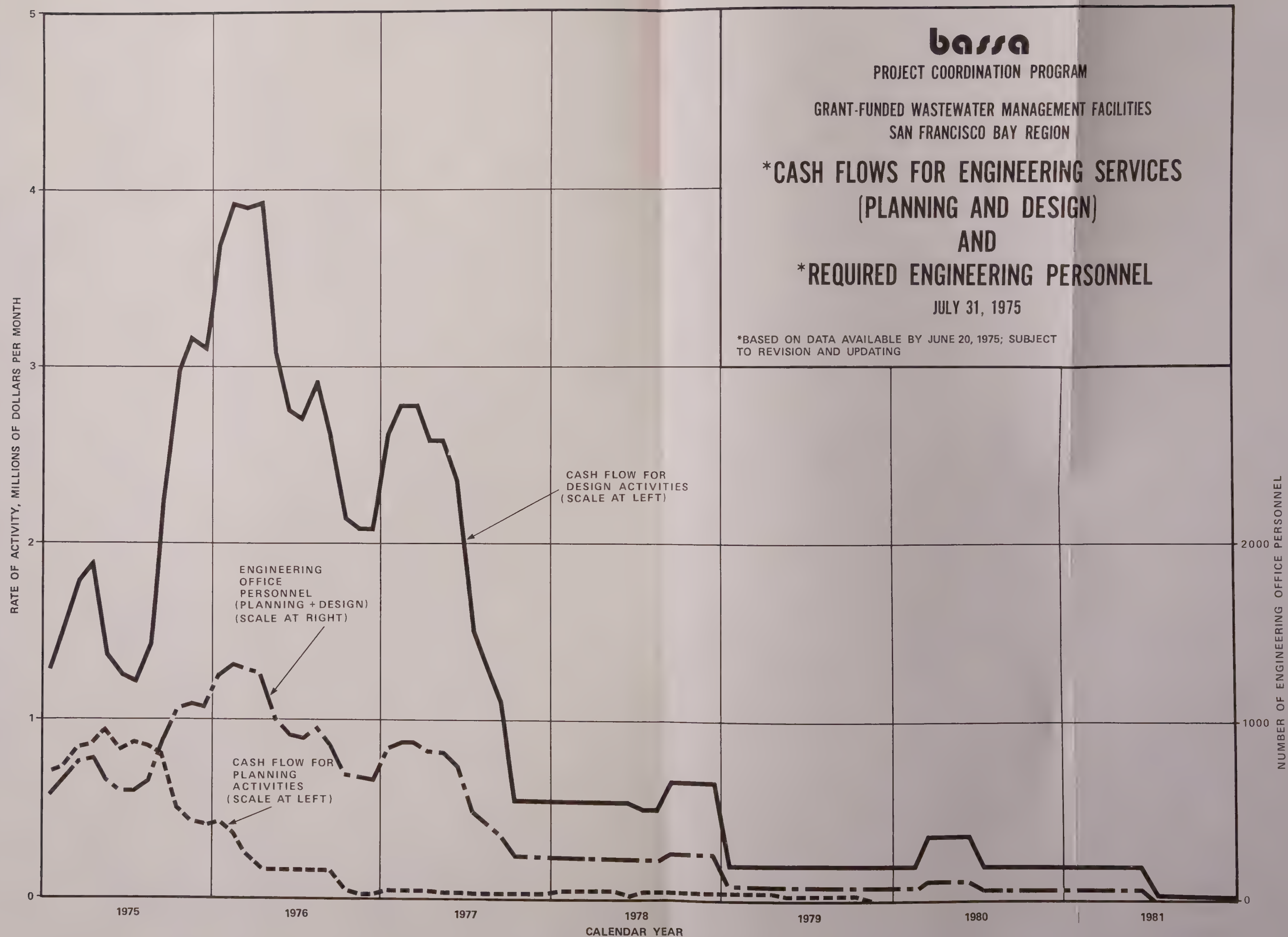
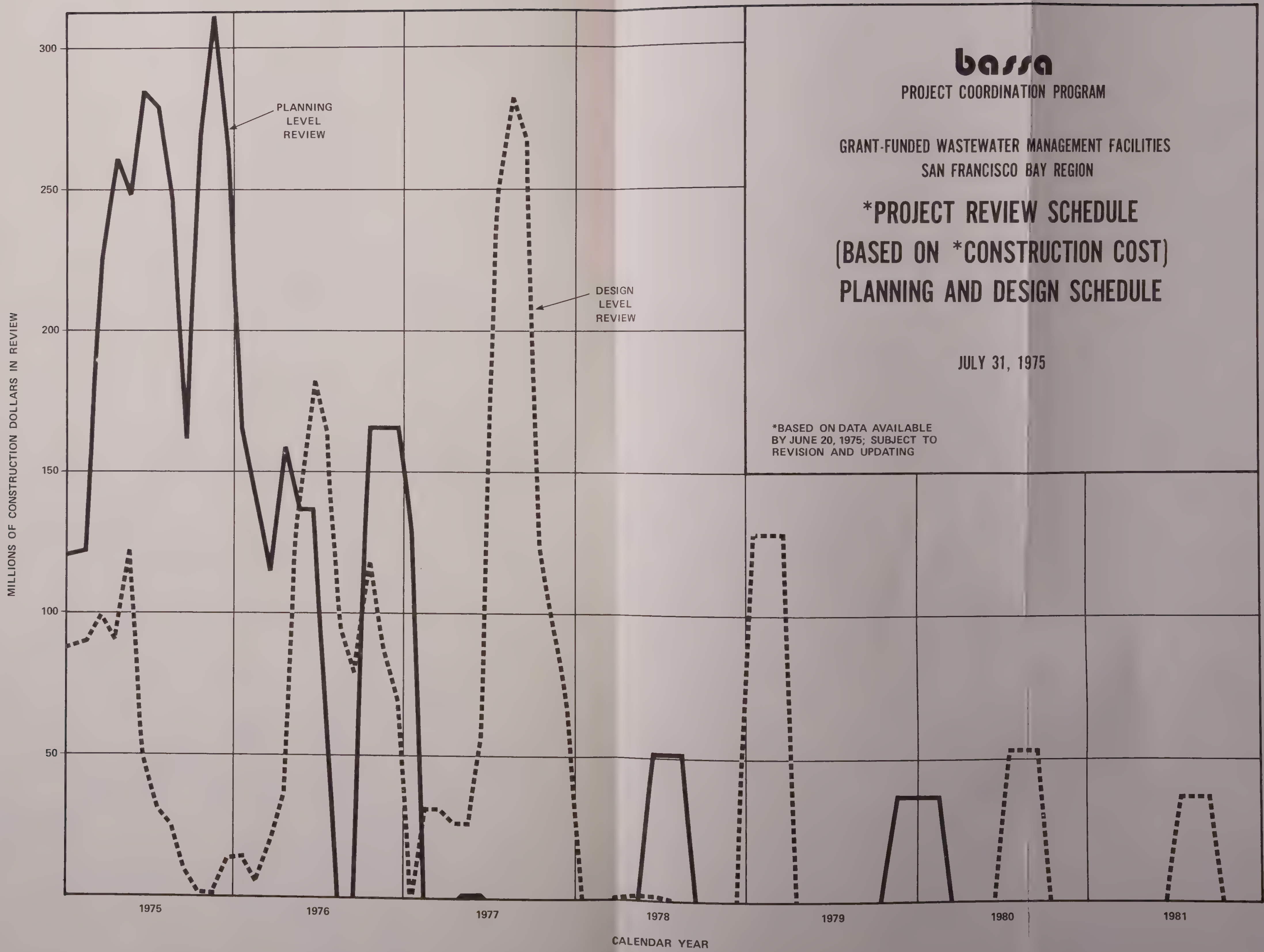
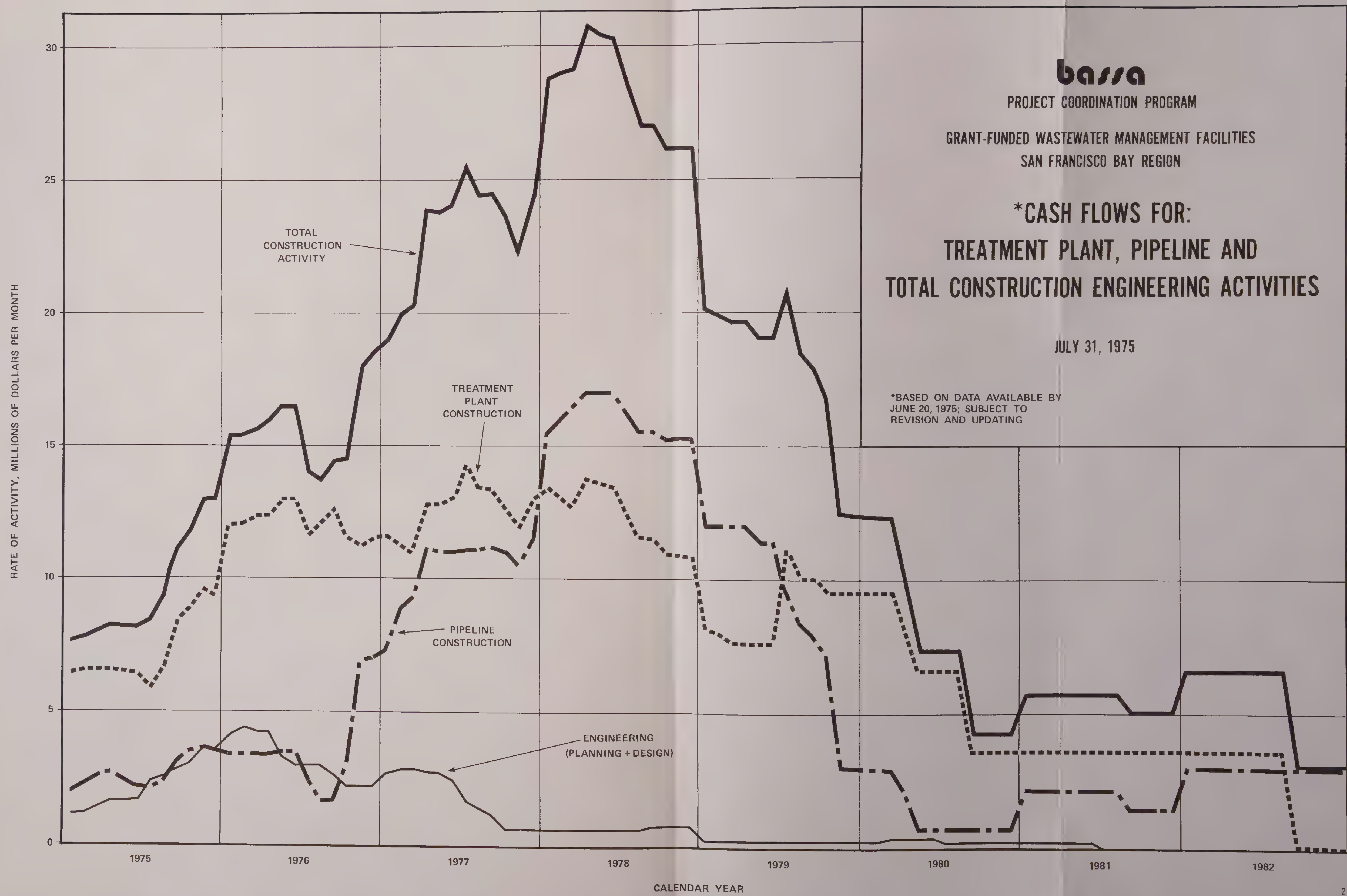

bassa
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
*CASH FLOWS FOR ENGINEERING SERVICES
(PLANNING AND DESIGN)
AND
*REQUIRED ENGINEERING PERSONNEL
JULY 31, 1975
*BASED ON DATA AVAILABLE BY JUNE 20, 1975; SUBJECT TO REVISION AND UPDATING
RATE OF ACTIVITY, MILLIONS OF DOLLARS PER MONTH
0
1
2
3
4
5
NUMBER OF ENGINEERING OFFICE PERSONNEL
0
1000
2000
CASH FLOW FOR DESIGN ACTIVITIES (SCALE AT LEFT)
ENGINEERING OFFICE PERSONNEL (PLANNING + DESIGN) (SCALE AT RIGHT)
CASH FLOW FOR PLANNING ACTIVITIES (SCALE AT LEFT)
1975
1976
1977
1978
1979
1980
1981
CALENDAR YEAR

FIGURE III-1



bassa
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
*PROJECT REVIEW SCHEDULE
(BASED ON *CONSTRUCTION COST)
PLANNING AND DESIGN SCHEDULE
JULY 31, 1975
*BASED ON DATA AVAILABLE BY JUNE 20, 1975; SUBJECT TO REVISION AND UPDATING
PLANNING LEVEL REVIEW
DESIGN LEVEL REVIEW
MILLIONS OF CONSTRUCTION DOLLARS IN REVIEW
300
250
200
150
100
50
1975
1976
1977
1978
1979
1980
1981
CALENDAR YEAR

FIGURE III-2



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PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
*CASH FLOWS FOR:
TREATMENT PLANT, PIPELINE AND
TOTAL CONSTRUCTION ENGINEERING ACTIVITIES
JULY 31, 1975
*BASED ON DATA AVAILABLE BY JUNE 20, 1975; SUBJECT TO REVISION AND UPDATING
TOTAL CONSTRUCTION ACTIVITY
TREATMENT PLANT CONSTRUCTION
PIPELINE CONSTRUCTION
ENGINEERING (PLANNING + DESIGN)
RATE OF ACTIVITY, MILLIONS OF DOLLARS PER MONTH
0
5
10
15
20
25
30
1975
1976
1977
1978
1979
1980
1981
1982
CALENDAR YEAR

FIGURE III-3

bassa

PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

*PROJECT COSTS VS. BID DATES (PIPELINE AND TREATMENT PLANT JOBS)

JULY 31, 1975

*BASED ON DATA AVAILABLE BY JUNE 20, 1975; SUBJECT TO REVISION AND UPDATING

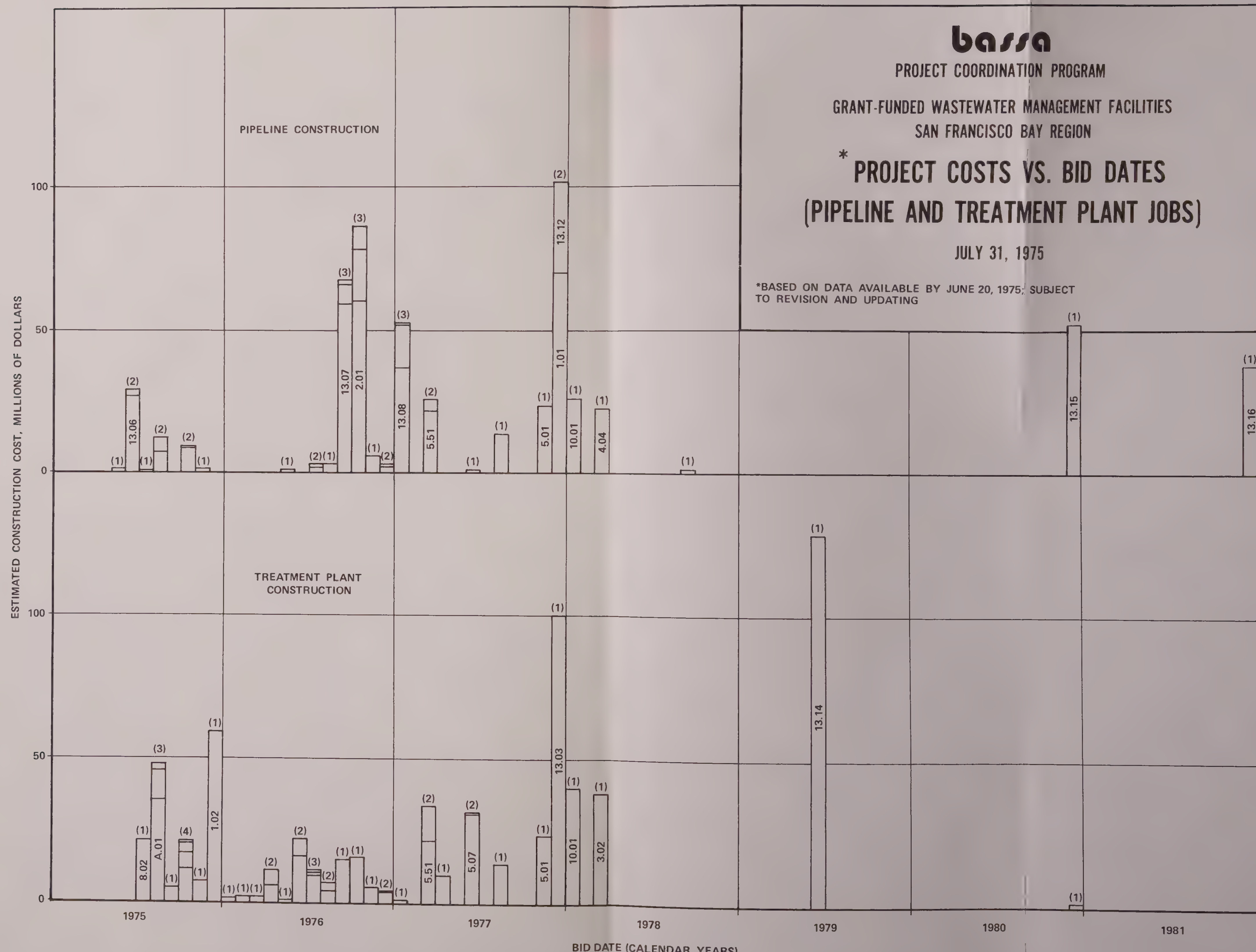


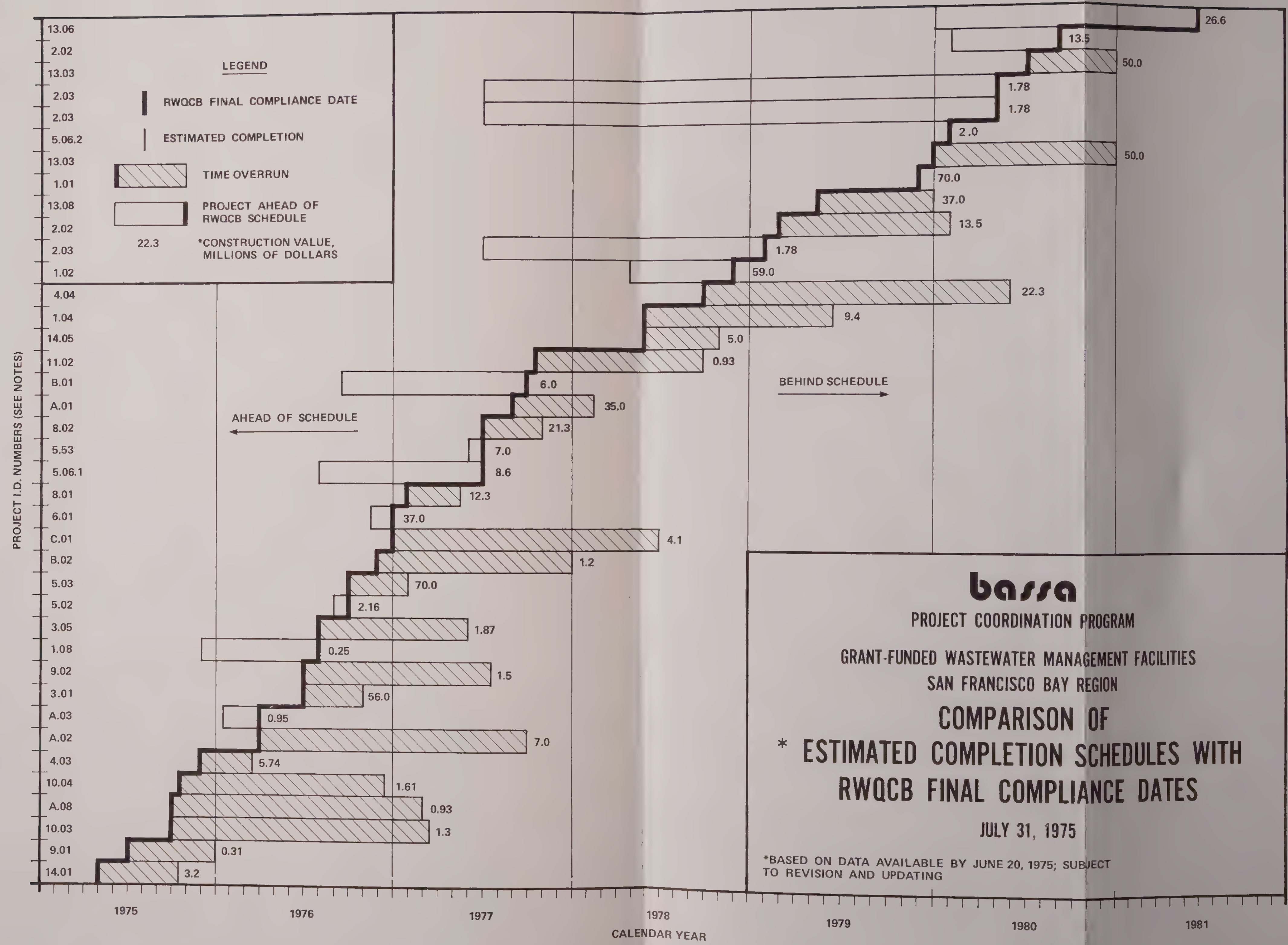
FIGURE III-4

TABLE III-1

APPARENT BID DATE CONFLICTS

TIME PERIOD	JOB	ESTIMATED CONSTRUCTION COST	ESTIMATED RWQCB COMPLIANCE	IMMEDIATE WATER QUALITY IMPACT
	Pipeline Jobs:			
2 months Fall 1976	East Bay Interceptor	$60 million	no date set	important
	S.F. No.Shore Outfall Consolidation	$60 million	"	Note 1
	S.F. Channel St. Outfall Consolidation	$20 million	"	"
Jan. 1977	S.F. West Side Transport	$35 million	8 months late	Note 1, 2
	S.F. Ocean Outfall Phase I	$15 million	no date set	"
3 months Winter 1977-1978	South Bay Interceptor	$70 million	on time	important
	East Contra Costa Subregional System	$20 million	no date set	nominal (local improvements)
	Marin County Subregional System	$25 million (Note 3)	"	"
	S.F. Ocean Outfall Phase II	$30 million	"	Note 1
	Treatment Plant Jobs:			
3 months Winter 1977-1978	East Contra Costa Subregional System	$20 million	no date set	nominal (local improvements)
	Marin County Subregional System	$40 million (Note 3)	"	"
	S.F. Southeast Plant	$100 million	6-12 months late	important

1. Water quality impact of most S.F. transport projects will be minimal until completion of crosstown tunnel and Phase I of Southwest Treatment Plant sometime around 1983-4.
2. These two projects, by relocating present ocean discharge, will have partial impact at completion in early 1980.
3. Probably will go to bid as several smaller jobs.



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PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

COMPARISON OF * ESTIMATED COMPLETION SCHEDULES WITH RWQCB FINAL COMPLIANCE DATES

JULY 31, 1975

*BASED ON DATA AVAILABLE BY JUNE 20, 1975; SUBJECT TO REVISION AND UPDATING

FIGURE III-5

TABLE III-2

PROJECTS WITH POSSIBLE CONSTRUCTION SCHEDULING PROBLEMS

PROJECT	ESTIMATED COST $ MILLION	APPROXIMATE CONSTRUCTION START DATE	APPROXIMATE COMPLETION DATE	SCHEDULED CONSTRUCTION TIME (MONTHS)	NPDES COMPLIANCE DATE	ESTIMATED CONSTRUCTION TIME, CASH FLOW BASIS (MONTHS)	ESTIMATED EQUIP. DELIVERY & INSTALLATION TIME (MONTHS)	WATER QUALITY IMPACT	COMMENTS
South Bay Interceptor	70.	1-1-78	11-1-79	22	12-1-79	23	27	important	Equipment prepurchase seems desirable.
San Jose/Santa Clara Plant	59.	1-1-76	1-1-78	24	12-1-78	33	32	important	Sufficient time to compliance date to lengthen schedule.
Alviso Interceptor	0.25	8-1-75	11-1-75	3	8-1-76	6	-	local improvement	"
EBMUD Sludge Facilities	16.	7-15-76	2-1-78	18½	--	26	23	nil	No impediment to lengthening schedule.
East Contra Costa Subregional System	47.	12-1-77	8-1-79	20	--	26	23	local improvement	"
Contra Costa C.S.D. No. 15 Collection	8.6	11-15-75	7-15-76	8	7-1-77	16	-	"	Sufficient time to compliance date to lengthen schedule.
Central Contra Costa S.D. Solids & Energy	31.	7-1-77	1-1-79	18	--	30	26	nil	No impediment to lengthening schedule.
Crockett-Valona & C&H Plant	7.	12-15-75	2-1-77	13½	7-1-77	22	21	local improvement	Tight schedule. May need easing of compliance date.
Graton Collection, Treatment	1.65	5-15-76	1-1-77	7½	--	11½	-	"	No impediment to lengthening schedule.
Guerneville Collection, Treatment	11.	12-15-76	1-1-78	12½	--	21	21	"	"
Cloverdale Plant	0.9	8-1-76	1-1-77	5	10-1-75	12	-	"	Big compliance overrun. Construction schedule seems unrealistically short.
Vacaville Plant	6.	7-1-76	7-1-77	12	10-1-77	21	21	"	Schedule seems unrealistically short. May need easing of compliance date.
Sonoma Valley C.S.D. Plant	9.4	8-15-76	3-1-78	18½	--	24	22	"	No impediment to lengthening schedule.
S.F. Islais Creek Outfall Consolidation	6.4	10-1-76	11-1-77	13	--	18	-	local improvement in wet weather see Note 1	"
S.F. Ocean Outfall Phase I	14.7	2-1-77	8-1-78	18	--	26	24	local improvement see Note 1	No impediment to lengthening schedule. Coordination with construction of Outfall Phase II may be important.
Redwood City et al Plant and Outfall	23.4	12-15-76	7-1-78	18½	6-1-78	26	24	local improvement	Construction schedule seems unrealistically short. May need easing of compliance date. Maybe can advance start of construction.

Note 1: These San Francisco projects will not be fully effective until the crosstown tunnel and Phase I of the Southwest Plant are complete, circa 1984.

CHAPTER IV

WATER QUALITY EFFECTS

The purpose of constructing wastewater management facilities is to improve water quality. Hence, a major segment of this study is the examination of the impact of the various projects on water quality. Knowledge of the relative impacts of the projects is important from a scheduling point of view. Where conflicts or delays occur that jeopardize schedules, informed decisions can be made with the aid of proper awareness of the water quality effects of the project or projects involved.

METHOD OF INVESTIGATION

This study uses earlier work by other investigators to help evaluate the anticipated water quality changes in San Francisco Bay resulting from the Bay Area pollution control projects. Three previously completed studies included usable information, allowing us to evaluate waste discharge data with resulting water quality projections. This information and the sources are described below.

1. In the study that resulted in "Final Report to the State of California, San Francisco Bay Delta Water Quality Control Program," by Kaiser Engineers, June, 1969, sets of "influence lines" were developed (but not published). The "influence lines" are results of computer runs using a geometry of junctions and channels to represent the San Francisco Bay and Delta. Unit waste loads were imposed at some thirty junctions or locations, one at a time, with resulting computed concentrations at all junctions. This set of concentrations constitutes the "influence lines." Using these concentrations or sets of predictive coefficients, differing loads can be applied to any or all of the thirty waste input locations. The resulting summary of all input effects on a given location is the water quality at that location resulting from the loads. Two coefficient sets are used in this study: one for a conservative material and one for a non-conservative material with a 0.2/day rate coefficient. The assumed boundary conditions for the development of these coefficients were 1990 dry year, net Delta outflow of 2000 cfs, and a tidal exchange of 0.2.

2. A study entitled "Dispersion Capability of San Francisco Bay-Delta Waters" by Austin W. Nelson and Richard J. Lemeth, California State Water Resources Control Board, Publication No. 45, dated August 1972, includes a matrix of prediction coefficients. The coefficients are similar to the earlier Kaiser information and are for a conservative material, with 18 locations for input waste loads and 19 locations of predicted water quality, using the same geometry as the Kaiser study. The tidal exchange was 0.24, the tide was typical and synthesized, and the net Delta outflow was 1800 cfs, with summer hydrological conditions. The principal differences in the Kaiser and the State sets of conservative coefficients resulted from the choice of dispersion coefficients. Because of their similarity and the greater flexibility of input loads and resulting information from the Kaiser coefficients, only the latter were used.

3. In March of 1972, Consoer-Bechtel completed "Water Quality Management Plan for South San Francisco Bay," prepared for the South Bay Dischargers. The Appendices of this study contain a matrix of coefficients for use with oxygen-demanding waste loads. The area represented by the matrix provides information on the dissolved oxygen deficits resulting from the loads. There are fourteen waste load input polygons or locations and a benthos demand. The results are given for eighty-four locations. The waste load input locations are south of Dumbarton Bridge and along the west side of the Bay to San Francisco Airport. The matrix is for the dry season.

For the sake of efficiency and accuracy, a short data processing computer program was written to produce all results plotted in this chapter. The program used the appropriate predictive coefficients and calculated all concentrations. The input was the appropriate waste loads.

The following limitations and conditions apply to the results given in this chapter:

- The results displayed are based on steady-state conditions.
- The available matrix load points do not always coincide with the real waste load input points. Where points are not coincident, the nearest matrix input point is used.

- Industrial dischargers not tributary to municipal systems are not included.
- Municipal dischargers' projects that are not part of the grant-funded program are not included.
- Analyses are for the dry season. Storm runoff inputs are not included.
- Background pollutant inputs, e.g. from the atmosphere, the ocean, and dry weather stream flows are not included.
- The NPDES permit requirements for treatment levels and relocations/consolidations are used to represent effluent quality after project completion. Present discharge rates are used throughout.
- The discharger agencies' current schedules of completion dates from the project implementation schedules (Appendix A) are used.

This study does not attempt to evaluate and justify individual projects in the grant-funded program. The results obtained are relative, not absolute, because of the limitations listed above. The intention of this portion of the work is simply to compare on that relative basis water quality impacts of the various projects. It is hoped that this will aid decision-making in the process toward implementation.

DESCRIPTION OF ANALYSES AND DISCUSSION

The analysis results are presented as a series of water quality profiles. Figure IV-1 is a key map showing the locations in the bay of the profiles shown on the Figures IV-2 through IV-8. The analyses are as follows:

Dissolved Oxygen Level

This analysis was performed using the coefficients from the South Bay Dischargers' study. Because that study was limited to the South Bay, the present analysis was similarly limited (see Figure IV-1). However, results using the Kaiser study coefficients for the whole bay, reported later in this chapter, show clearly that the South Bay is the principal area of major concern for water quality.

Figure IV-2 shows the calculated dissolved oxygen levels, as a percent of saturation, resulting from the ultimate oxygen demand (UOD) loads. These loads reflect changes in treatment levels and consolidations/relocations. The figure consists of a series of water quality profiles in time sequence as the various projects come on line. (Because of the limitation in the original model on input load points, no East Bay loadings north of Dumbarton Bridge could be studied in this analysis.)

The main-channel profile plotted is, so far as model results are concerned, the line of lowest dissolved oxygen levels south of Dumbarton Bridge, and very nearly so north of that bridge. Thus, except for possible local effects which cannot be modelled, the predicted inshore dissolved oxygen conditions are at least as good as those shown on the profiles of Figure IV-2.

The main findings from Figure IV-2 are:

- The San Jose/Santa Clara Treatment Project shows the most improvement on saturation levels of any project. One reason is that this is the first major project to be completed in that subregion.

- The area south of Dumbarton Bridge is significantly improved by all projects in that area with respect to dissolved oxygen saturation.

- The three San Mateo sets of projects have their primary influence on dissolved oxygen saturation between the Dumbarton and San Mateo Bridges. They have some effect to about three miles south of the Dumbarton Bridge.

An assessment was made of the cumulative effects of all treatment projects vs. all transport projects included in Figure IV-2. This comparison is shown in Figure IV-3, again in terms of dissolved oxygen profiles. The main findings from this analysis are:

- Completion of the South Bay Dischargers' interceptor and other transport projects without construction of any improved treatment would remove the extreme dissolved oxygen sag from south of Dumbarton Bridge, but would cause a severe sag at the new discharge point north of the bridge.

- Construction of all proposed treatment improvements with no transport projects would result in substantially improved dissolved oxygen levels, especially south of Dumbarton Bridge.

- Construction of all proposed treatment and transport projects will result in the best improvement of dissolved oxygen levels. Treatment plus transport will eliminate the large oxygen sag that would result just north of the Dumbarton Bridge if transport only were provided. Treatment plus transport will provide dissolved oxygen levels south of Dumbarton Bridge significantly higher than if improved treatment only were constructed. (See also the section of this chapter on wastewater concentration.)

Biochemical Oxygen Demand

This analysis and those following were performed using the coefficients from the Kaiser study model. Results are shown for the main channel of the entire bay system as shown on Figure IV-1. The waste constituent considered here is 5-day BOD, a material which decays with time.

Figure IV-4 gives profiles of 5-day BOD concentration for successive year-ends through 1980, as all the various projects come on line. Figure IV-5 is similar, but only transport projects are included. By comparing the two figures, a better understanding of the separate effects of treatment and transport can be gained.

Principal results from Figure IV-4 are:

- The 1980 BOD_5 concentration levels show improvements over previous years throughout the bay, with the exception of a concentration peak south of the Bay Bridge. This peak is due to San Francisco's North Point to Southeast Transport Project, which will move a large primary discharge from San Francisco's north waterfront to the vicinity of Hunter's Point.

  Resulting BOD_5 concentration at this point is still well below the calculated maximum value at which an 80 percent dissolved oxygen saturation level could just be maintained, assuming an 80 percent level over a considerable surrounding area. (San Francisco projects to be completed after 1980 will provide secondary treatment at the Southeast Plant and, finally, ocean discharge.)

- BOD_5 concentrations north of the Richmond Bridge indicate that there should be no dissolved oxygen problems at all.

Any possible problems would be a) of a local nature, b) would be a result of dischargers not considered in this study, or c) would be for conditions other than those studied.

- The 1975 BOD_5 peak north of the Bay Bridge is a result of the present East Bay MUD primary discharge. It disappears with improved treatment.

- By far, the greatest improvement occurs in the South Bay, especially south of Dumbarton Bridge.

The principal findings from Figure IV-5 (Transport Projects Only) are:

- The concentration peaks shown for 1975 indicate the location of major discharges. These are in two areas: those grouped south of Dumbarton Bridge and the East Bay Municipal Utility District discharge north of the Bay Bridge.

- The 1979 concentrations reflect the changes resulting from the South Bay Dischargers' outfall and the East Bay Discharger outfall relocations. These produce the large concentration peak just north of Dumbarton Bridge and the small peak about five miles south of the Bay Bridge, respectively.

- The major shift in 1980 is the movement of the San Francisco North Point waste load to the S. F. Southeast Plant. This is shown on the figure as a high peak five miles south of the Bay Bridge. This peak is well below the calculated maximum allowable BOD_5 concentration at that point.

For both figures, the concentrations given are fairly representative of results for shallower inshore areas as well as for the main channel. A few local small concentration peaks will appear in the vicinity of new outfall locations. Other findings:

- It is seen from these figures that the major area in the bay of present concern for BOD_5 loading is the portion south of Dumbarton Bridge. North of the Richmond Bridge, BOD loadings (except perhaps on a local basis in inshore waters or sloughs) would appear to be no problem at all.

- Comparison of Figures IV-4 and IV-5 shows again that both treatment and transport make significant contributions to improving water quality in the South Bay.

Non-Decaying Pollutant

The next two figures, IV-6 and IV-7, are based on concentrations of a conservative or non-decaying material. The waste loads from the various sources have been taken for convenience as identical in quantity to the BOD_5 loads used in the preceding analysis. These figures are representative in general of results for conservative constituents; for a different level of input loading, output would of course be in proportion to input in magnitude.

Figure IV-6 presents a time sequence of year-end profiles through 1980 for the entire bay system, as located on Figure IV-1. The sequence of profiles shows changes in concentration of the conservative constituent described above as the various treatment and transport projects are completed. For this figure, the conservative material is assumed to be one amenable to removal by treatment. Thus, projects providing improved treatment produce reductions in waste loads. Major findings from Figure IV-6 are:

- As with BOD_5, the most important present concentrations of a constituent such as this are in the extreme South Bay.
- The major effects on water quality are quite apparent. The most visible change for 1977 is improved treatment for EBMUD (just north of the Bay Bridge). The greatest of several changes for 1978 is improved treatment for San Jose/Santa Clara (far South Bay); also, one project for Sunnyvale and two for San Mateo County will be on line. For 1979, the major change is the completion of the South Bay Interceptor, moving those discharges from the far South Bay to just north of the Dumbarton Bridge. In 1980, the East Bay Interceptor will be completed, moving those discharges from the far South Bay to a bit south of the Bay Bridge; also, San Francisco's North Point discharge will be moved to Hunter's Point, a bit south of the Bay Bridge.

Figure IV-7 is similar to Figure IV-6, with the exception that the conservative material is now assumed to be one not amenable to removal by treatment. Thus, only the transport projects in the grant-funded program are reflected in the time sequence of of water quality profiles. Major findings of this figure are:

- The sequence of changes is similar to that described above for Figure IV-6, with the difference that higher concentrations are shown for the later years because it is assumed that the new treatment projects will produce no pollutant reductions.

- Concentrations in the South Bay between the Bay Bridge and Dumbarton Bridge are higher in 1980 than in 1975. This is due to the transfer of San Francisco's present North Point discharge to the location of the Southeast Plant, a bit south of the Bay Bridge. This is a rather typical response when a pollutant discharge is moved further inside the Bay. Fortunately, in San Francisco's planning, this large discharge will be temporary.

- Concentrations in San Pablo Bay are also up in 1980, and for the same reason: transfer of the present San Francisco North Point discharge to the Southeast site. Material discharged off San Francisco's north shore is carried fairly directly out the Golden Gate, but material discharged further inside the bar apparently enters the bay's circulation pattern and is distributed as far as San Pablo Bay.

Because Figures IV-6 and IV-7 do not represent specific pollutants, but are intended to be characteristic of certain classes of conservative materials, no limiting or allowable concentration values can be shown.

Fraction of Wastewater

The effects of a number of wastewater constituents are not well understood. The engineering profession has defined a concept called toxicity and measures it by means of the mortality of certain test fish or other organisms. What constitutes toxicity, however, is still being studied. Therefore, how toxicity levels will be affected by new treatment projects, industrial source control programs, etc., cannot be predicted with any accuracy. The same is true of biostimulatory materials.

Recent studies in New Orleans and elsewhere revealed significant amounts of a number of potentially carcinogenic constituents in water sources containing substantial intermixed waste effluents.

A number of constituents pass essentially unaltered and undiminished through present types of treatment plants. Some of these may well be undesirable or harmful.

Figure IV-8 presents a series of time-sequence profiles for the bay in the same fashion as earlier figures; these profiles represent simply the percent of wastewater in the total receiving water volume at any given point. The degree of dilution of

wastewater and, hence, of any constituents not affected by treatment is shown directly in the figure. Changes from year to year in the profiles are due to transport projects that come on line.

Principal findings from Figure IV-8 are:

- At present and through 1978, the waters of the South Bay (below Dumbarton Bridge) consist of 10 to almost 50 percent wastewater during dry weather.

- Wastewater concentrations throughout the bay north of the Bay Bridge are now and remain below 1 percent. This comparison with the far South Bay indicates strongly why the most important water quality problems in the bay are south of the Dumbarton Bridge.

- Completion of the South Bay and East Bay Interceptors by 1980 cause the wastewater concentration in the South Bay to drop markedly. The highest level in the whole bay in 1980 will be about 7 percent at the South Bay Interceptor outfall location just north of Dumbarton Bridge. It is emphasized that this change is due to transport projects. While we have seen earlier that the various treatment projects will improve dissolved oxygen and BOD levels in the far South Bay very substantially, without transport, the wastewater concentration in the South Bay will remain at the high 1975 levels.

While no attempt has been made to deal directly and quantitatively with toxicity, it is felt that Figure IV-8 is a reasonable guide to anticipated distributions of toxicity in the bay.

CONCLUSIONS

The major conclusions regarding water quality in San Francisco Bay as affected by the grant-funded wastewater facilities program are as follows:

1. Projects in the South Bay are the most critical. Those south of Dumbarton Bridge are the most critical in the South Bay.

2. South of Dumbarton Bridge, treatment to the level of the NPDES permits appears to improve dissolved oxygen values

to the required levels. However, this conclusion should be viewed with some caution because a number of factors have not been included in these analyses. In particular, diurnal variations, wet weather inflows and separate industrial discharges were not evaluated.

3. The removal of discharges from south of Dumbarton Bridge will further improve dissolved oxygen levels and will reduce the bay's maximum wastewater percentage from 47 to 7 percent. The potential problems in the South Bay, which could result from high wastewater concentrations, will be largely alleviated.

4. Water quality problems in areas of the bay north of the Richmond Bridge do not appear to exist. Neither local dischargers nor influences from the southerly area of the bay seem to have much effect. There may be very local effects at discrete discharge locations, but at the scale of the grid used for modelling, these effects could not be observed.

5. The impact in 1980 of relocating the primary discharge of San Francisco's North Point Plant to the Southeast location is very evident. The resultant concentration peak seems well below any limiting level, however. Further, the condition is temporary: first, secondary treatment will reduce pollutants, then, the Southeast Plant effluent will be relocated to ocean discharge.

6. Public Law 92-500 is the major impetus behind the grant-funded facilities program, both in the Bay Area and nationally. In accordance with the water quality requirements of the act, the Environmental Protection Agency has set a minimum interim standard for all dischargers of 85 percent removal of BOD (secondary treatment). It would appear from the results of analyses in this chapter that this is the governing requirement for many of the projects in the program, as opposed to alleviation of specific receiving water problems.

NOTES ON DEVELOPMENT OF WATER QUALITY FIGURES

All Figures:

1. Results are for a steady-state mathematical model solution.

2. Present flows are used in all cases in developing input loads.

3. Input loads for existing discharges are based on present treatment levels. Input loads for discharges from newly completed treatment projects are based on treatment levels prescribed in the NPDES permits.

4. Project completion dates estimated by discharger agencies are used; some of these are not in compliance with NPDES permits.

5. Locations of profiles are shown on Figure IV-1.

Figures IV-2 and IV-3:

1. The predictive coefficients developed by Hydroscience for the South Bay Dischargers study are used.

2. Only dischargers south of Dumbarton Bridge and in San Mateo County are included.

3. The dissolved oxygen saturation concentration is assumed to be 7.1 mg/l.

4. A benthic demand is included.

5. Rate coefficient is 0.2 per day.

6. Ultimate oxygen demand is used in developing input loads.

Figures IV-4 and IV-5:

1. The predictive coefficients developed for the Kaiser 1968 Bay-Delta study are used.

2. Rate coefficient is 0.2 per day.

3. 5-day BOD is used in developing input loads.

Figures IV-6 to IV-8:

1. The predictive coefficients developed for the Kaiser 1968 Bay-Delta study are used.

2. Constituent of interest is a conservative (non-decaying) material.

3. Input loads are numerically equal to 5-day BOD for IV-6 and IV-7.

4. Input loads are proportional to waste flows for IV-8.

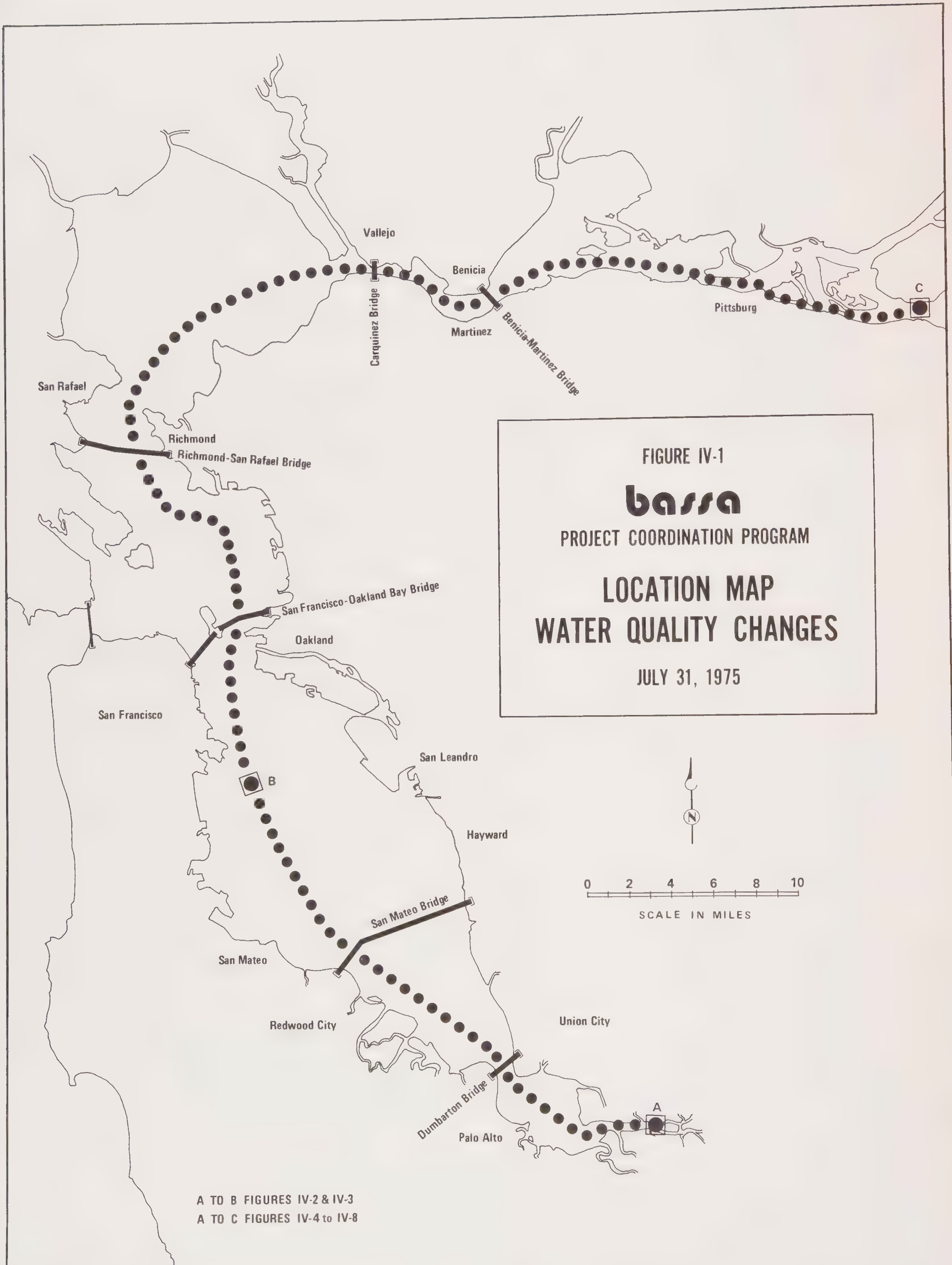


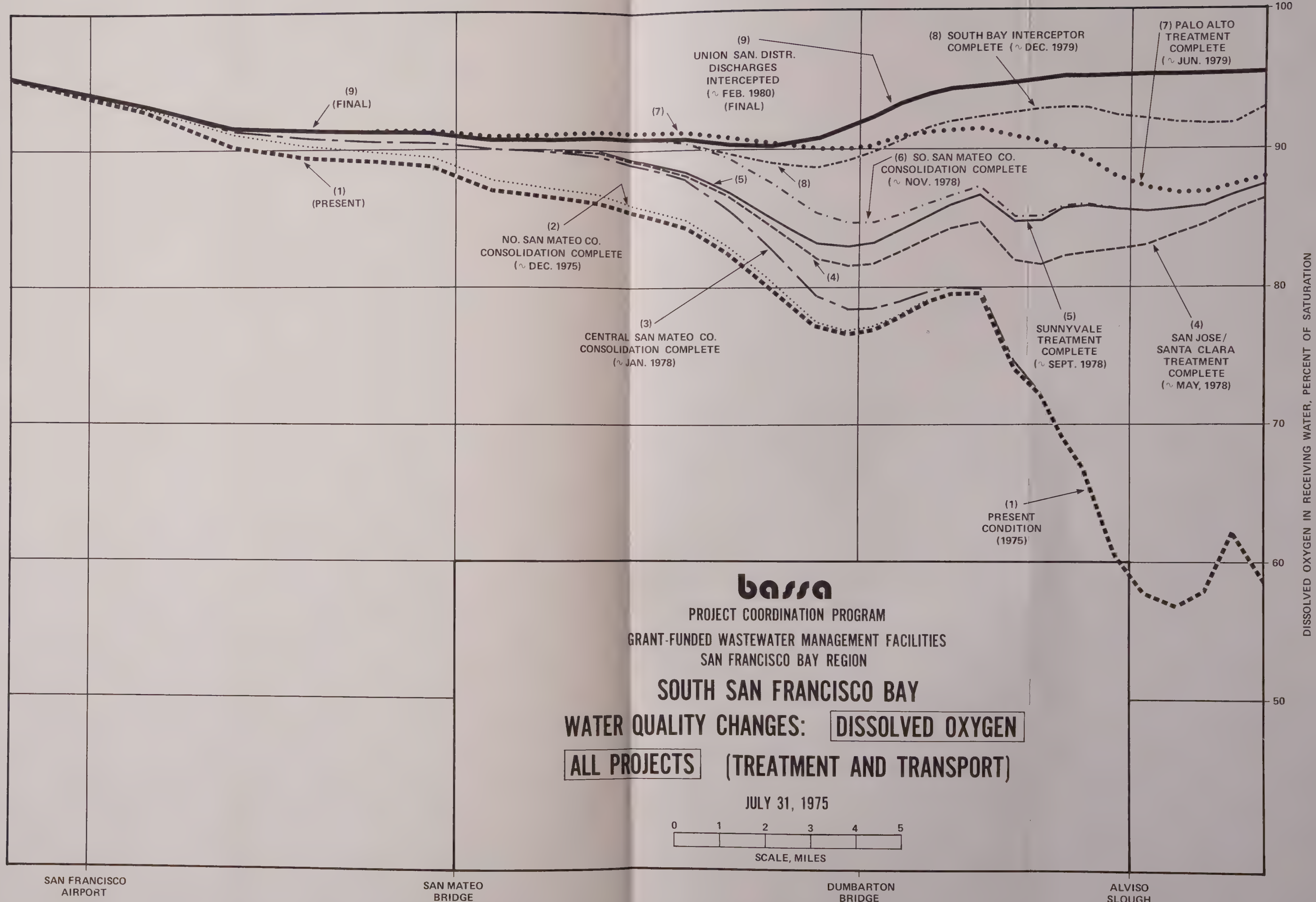
FIGURE IV-1

bassa

PROJECT COORDINATION PROGRAM

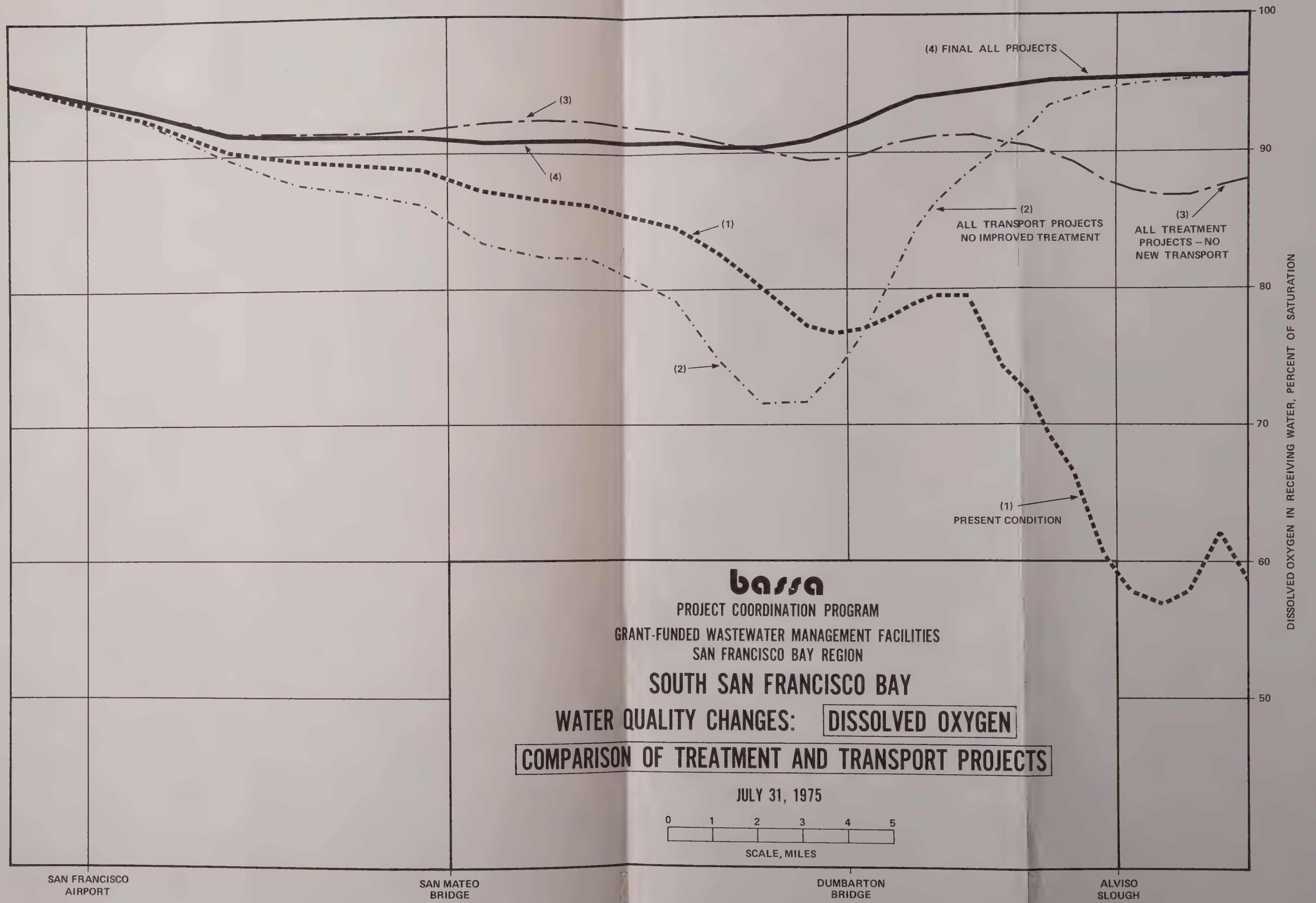
LOCATION MAP
WATER QUALITY CHANGES

JULY 31, 1975



(9)
UNION SAN. DISTR.
DISCHARGES
INTERCEPTED
(~ FEB. 1980)
(FINAL)
(8) SOUTH BAY INTERCEPTOR
COMPLETE (~ DEC. 1979)
(7) PALO ALTO
TREATMENT
COMPLETE
(~ JUN. 1979)
(9)
(FINAL)
(7)
(6) SO. SAN MATEO CO.
CONSOLIDATION COMPLETE
(~ NOV. 1978)
(5)
(8)
(1)
(PRESENT)
(2)
NO. SAN MATEO CO.
CONSOLIDATION COMPLETE
(~ DEC. 1975)
(4)
(3)
CENTRAL SAN MATEO CO.
CONSOLIDATION COMPLETE
(~ JAN. 1978)
(5)
SUNNYVALE
TREATMENT
COMPLETE
(~ SEPT. 1978)
(4)
SAN JOSE/
SANTA CLARA
TREATMENT
COMPLETE
(~ MAY, 1978)
(1)
PRESENT
CONDITION
(1975)
100
90
80
70
60
50
DISSOLVED OXYGEN IN RECEIVING WATER, PERCENT OF SATURATION
bassa
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
SOUTH SAN FRANCISCO BAY
WATER QUALITY CHANGES: DISSOLVED OXYGEN
ALL PROJECTS (TREATMENT AND TRANSPORT)
JULY 31, 1975
0 1 2 3 4 5
SCALE, MILES
SAN FRANCISCO
AIRPORT
SAN MATEO
BRIDGE
DUMBARTON
BRIDGE
ALVISO
SLOUGH

FIGURE IV-2



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PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION

SOUTH SAN FRANCISCO BAY

WATER QUALITY CHANGES: DISSOLVED OXYGEN

COMPARISON OF TREATMENT AND TRANSPORT PROJECTS

JULY 31, 1975

FIGURE IV-3

bassa

PROJECT COORDINATION PROGRAM

GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES

SAN FRANCISCO BAY REGION

SAN FRANCISCO, SAN PABLO AND SUISUN BAYS

WATER QUALITY CHANGES: 5 DAY BOD

ALL PROJECTS (TREATMENT AND TRANSPORT)

JULY 31, 1975

0 5 10 15 20

SCALE, MILES

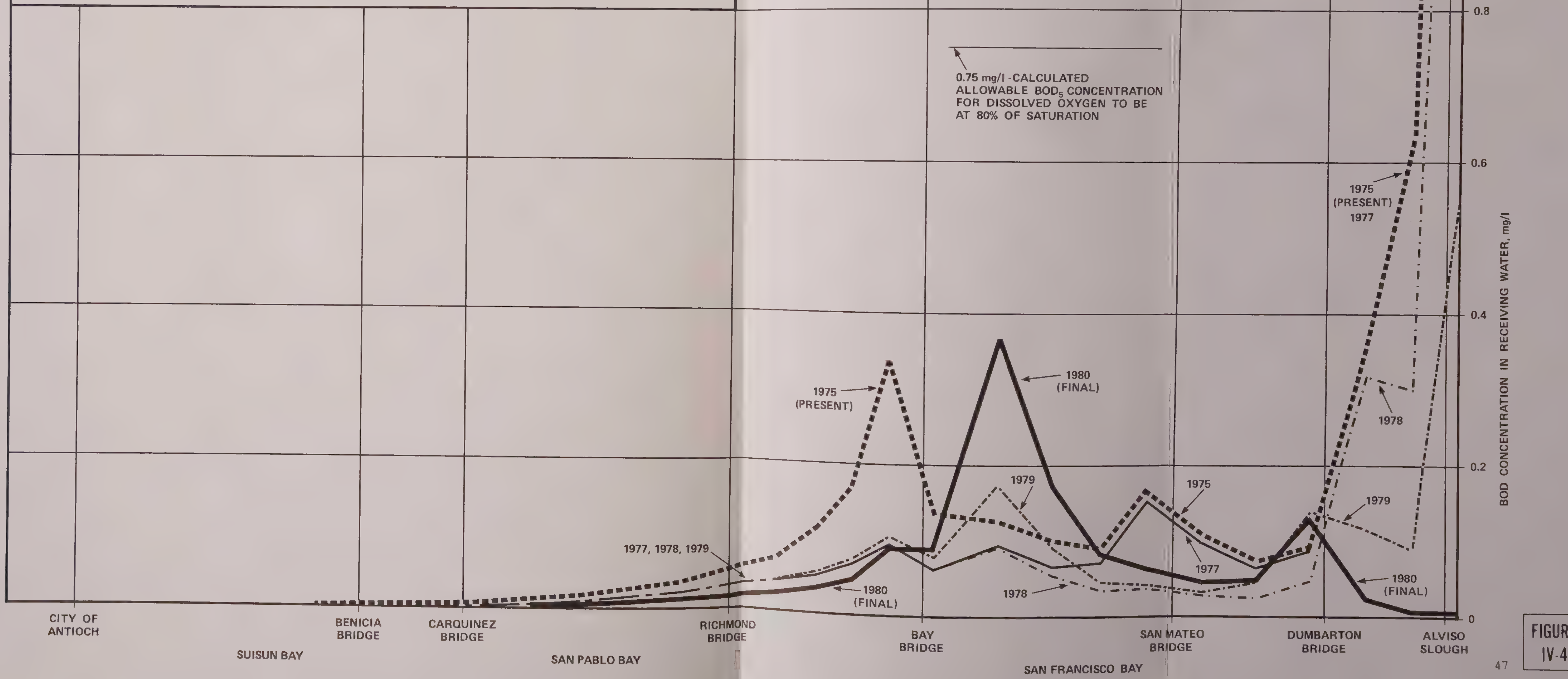
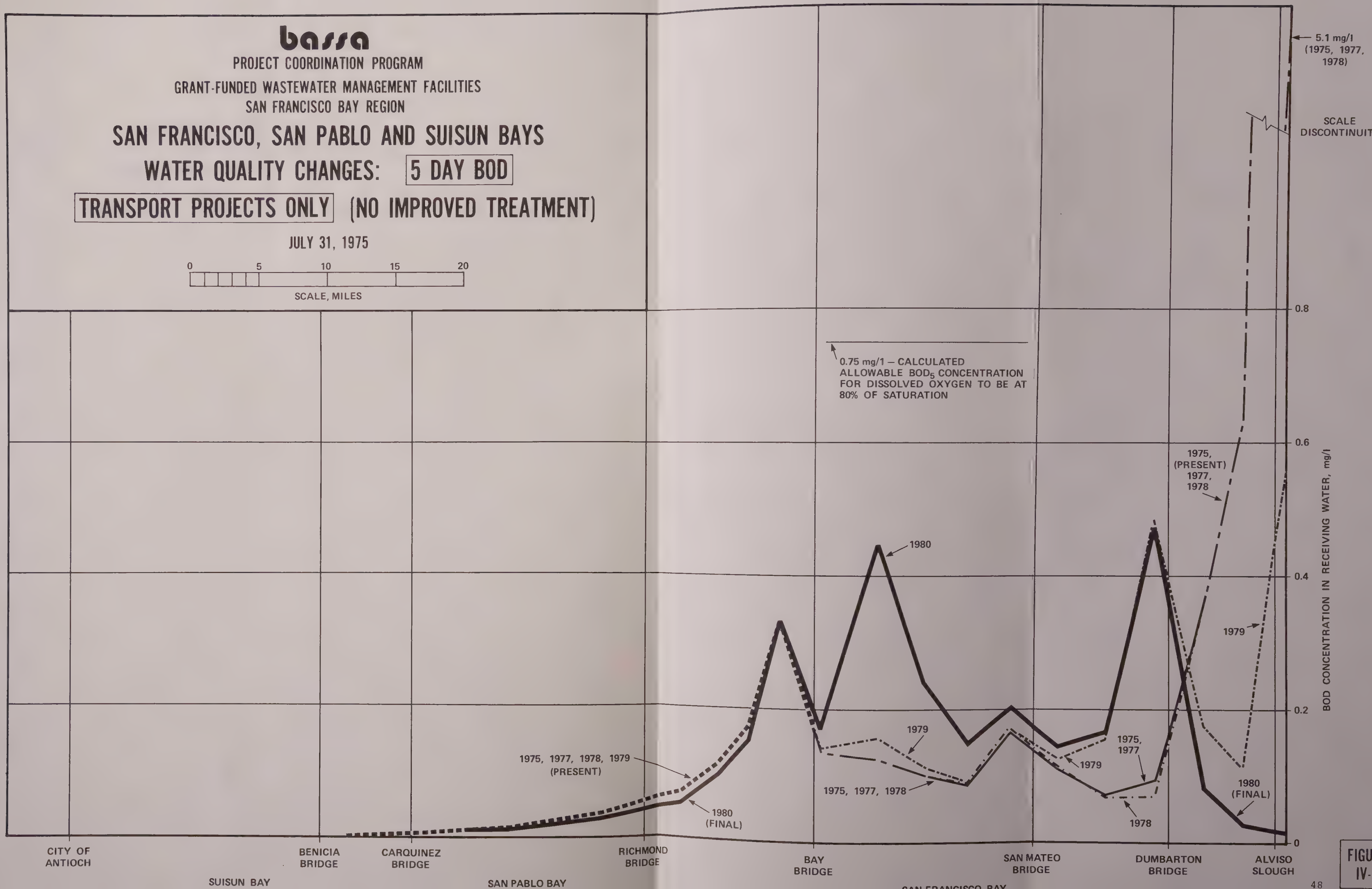


FIGURE IV-4



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PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: 5 DAY BOD
TRANSPORT PROJECTS ONLY (NO IMPROVED TREATMENT)
JULY 31, 1975
0
5
10
15
20
SCALE, MILES
0.75 mg/1 – CALCULATED ALLOWABLE BOD_5 CONCENTRATION FOR DISSOLVED OXYGEN TO BE AT 80% OF SATURATION
5.1 mg/l (1975, 1977, 1978)
SCALE DISCONTINUITY
1980
1975, (PRESENT) 1977, 1978
1979
1975, 1977, 1978, 1979 (PRESENT)
1980 (FINAL)
1979
1975, 1977, 1978
1979
1975, 1977
1978
1980 (FINAL)
0.8
0.6
0.4
0.2
0
BOD CONCENTRATION IN RECEIVING WATER, mg/l
CITY OF ANTIOCH
BENICIA BRIDGE
CARQUINEZ BRIDGE
RICHMOND BRIDGE
BAY BRIDGE
SAN MATEO BRIDGE
DUMBARTON BRIDGE
ALVISO SLOUGH
SUISUN BAY
SAN PABLO BAY
SAN FRANCISCO BAY

FIGURE IV-5

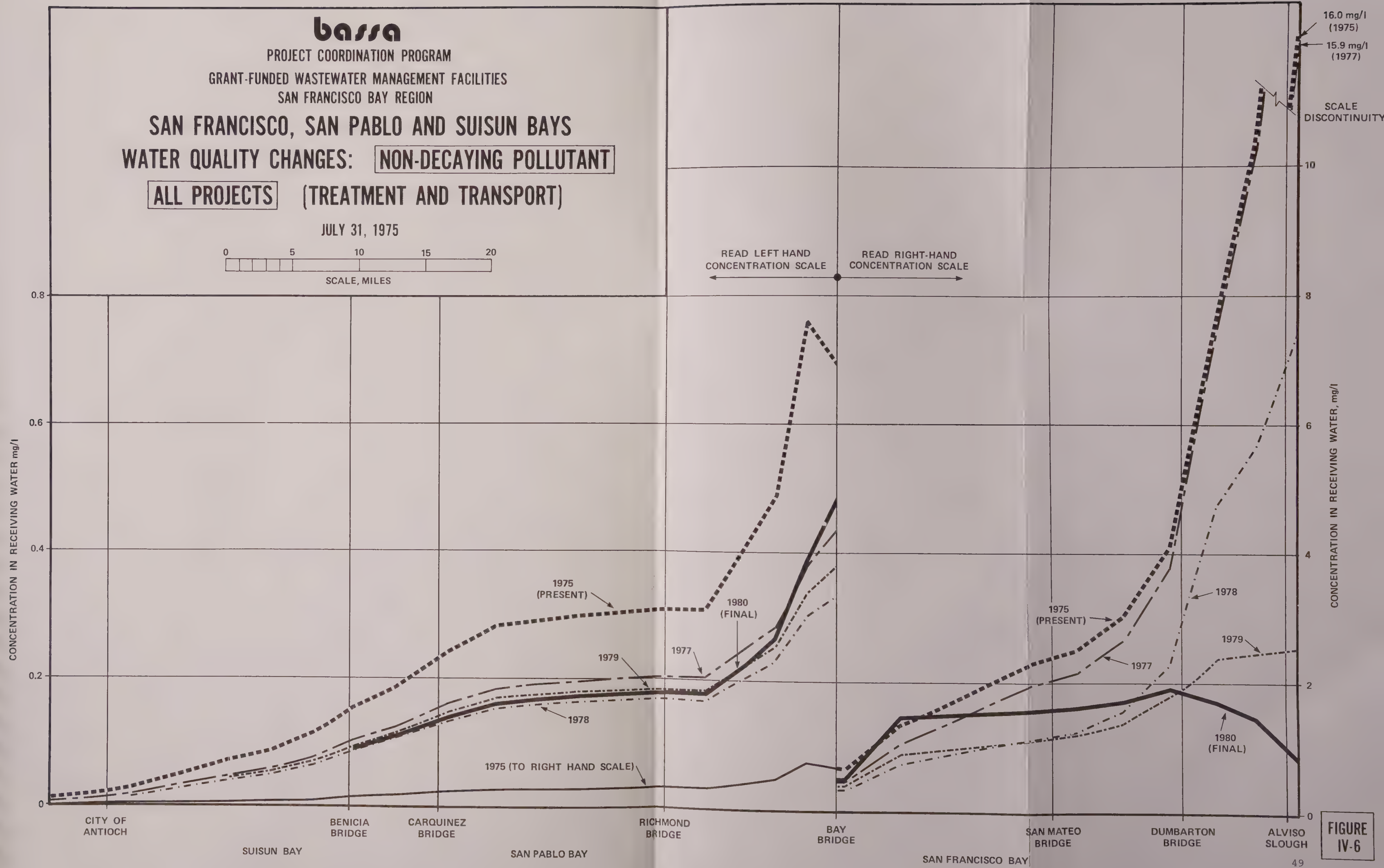
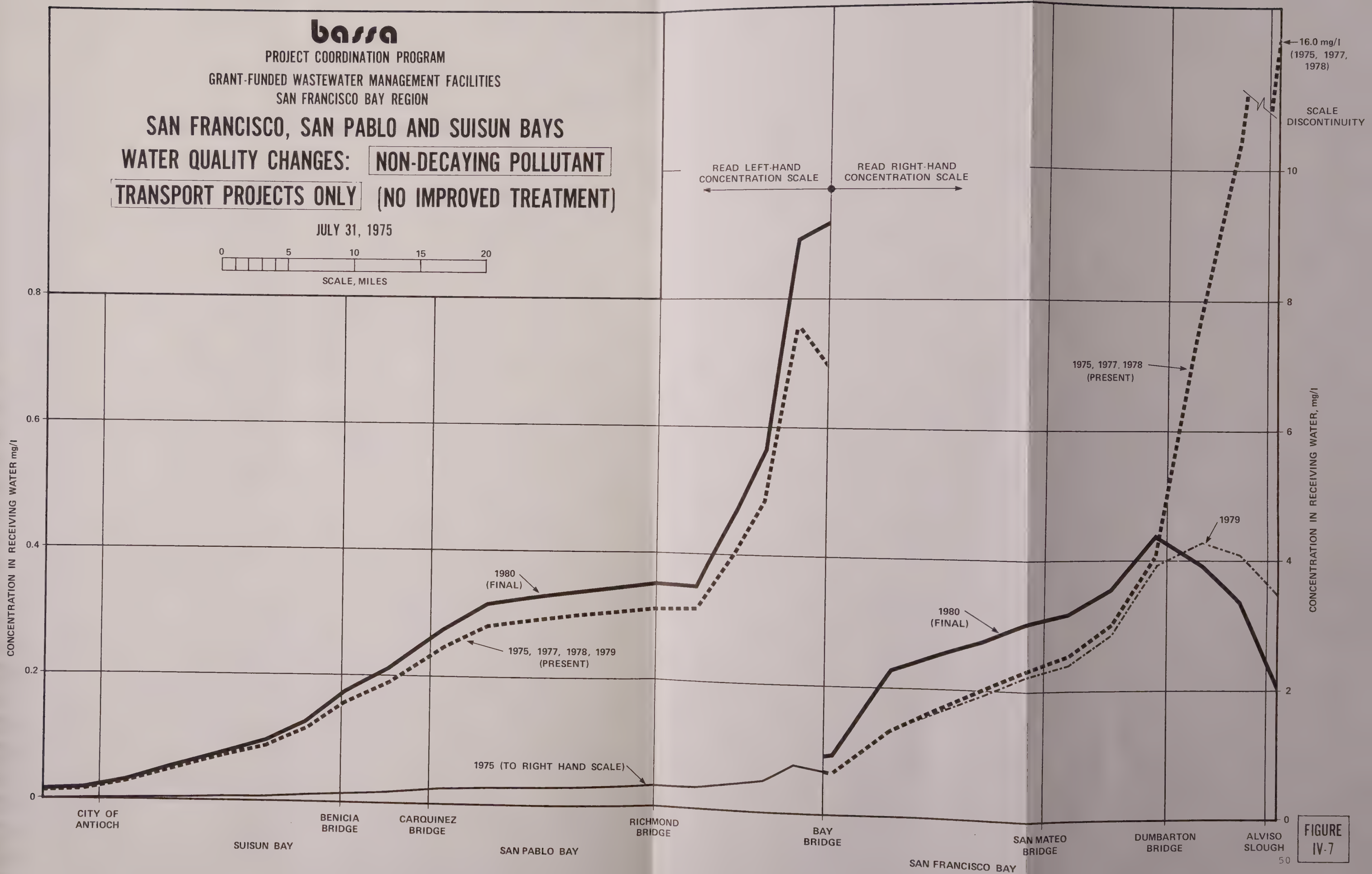

bassa
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: NON-DECAYING POLLUTANT
ALL PROJECTS (TREATMENT AND TRANSPORT)
JULY 31, 1975
0 5 10 15 20
SCALE, MILES
READ LEFT HAND CONCENTRATION SCALE
READ RIGHT-HAND CONCENTRATION SCALE
16.0 mg/l (1975)
15.9 mg/l (1977)
SCALE DISCONTINUITY
CONCENTRATION IN RECEIVING WATER mg/l
CONCENTRATION IN RECEIVING WATER, mg/l
0.8
0.6
0.4
0.2
0
10
8
6
4
2
0
1975 (PRESENT)
1980 (FINAL)
1977
1979
1978
1975 (TO RIGHT HAND SCALE)
CITY OF ANTIOCH
BENICIA BRIDGE
CARQUINEZ BRIDGE
RICHMOND BRIDGE
BAY BRIDGE
SAN MATEO BRIDGE
DUMBARTON BRIDGE
ALVISO SLOUGH
SUISUN BAY
SAN PABLO BAY
SAN FRANCISCO BAY

FIGURE IV-6



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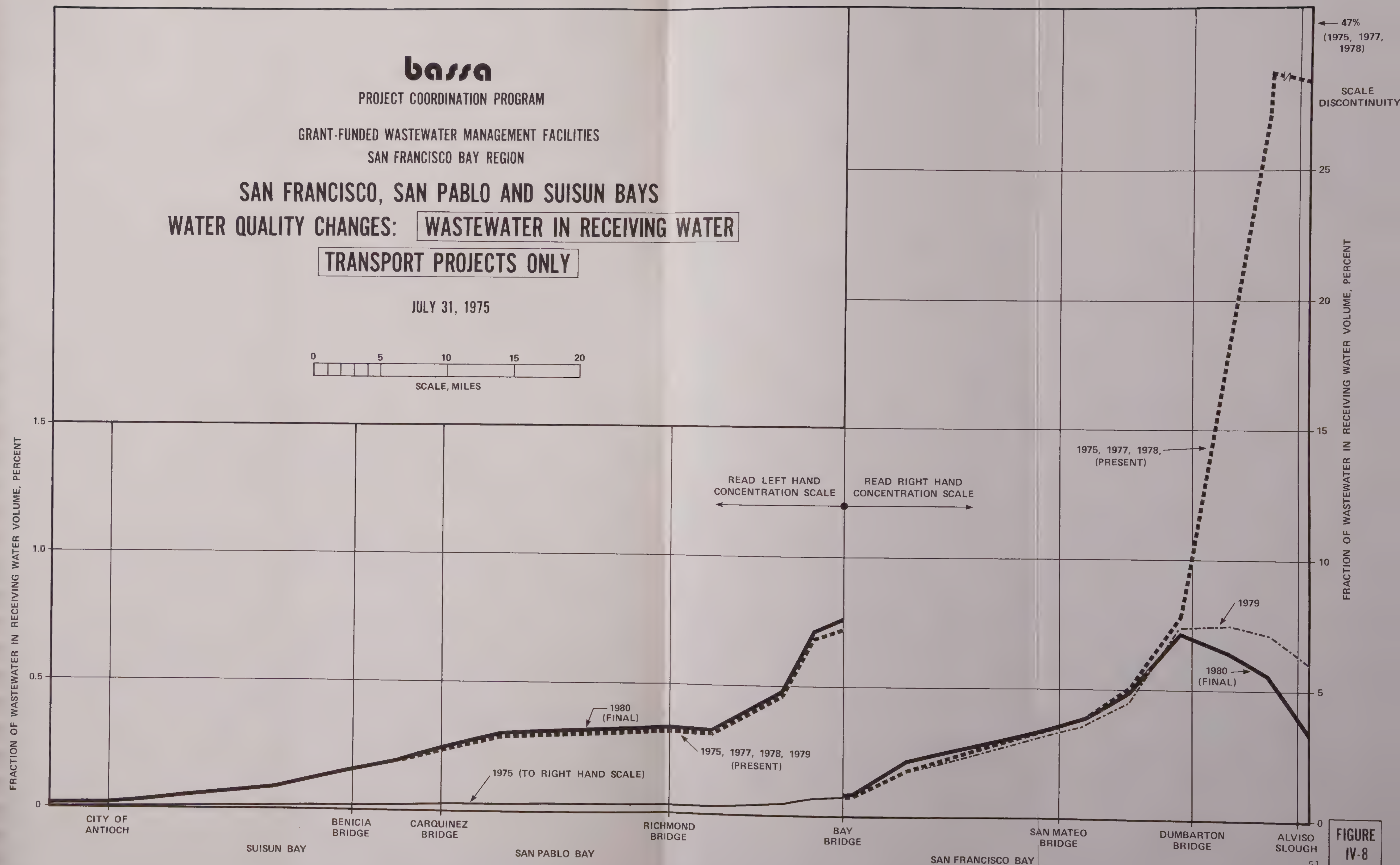
PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: NON-DECAYING POLLUTANT
TRANSPORT PROJECTS ONLY (NO IMPROVED TREATMENT)
JULY 31, 1975
0 5 10 15 20
SCALE, MILES
READ LEFT-HAND CONCENTRATION SCALE
READ RIGHT-HAND CONCENTRATION SCALE
16.0 mg/l (1975, 1977, 1978)
SCALE DISCONTINUITY
1975, 1977, 1978 (PRESENT)
1979
1980 (FINAL)
1975, 1977, 1978, 1979 (PRESENT)
1980 (FINAL)
1975 (TO RIGHT HAND SCALE)
CONCENTRATION IN RECEIVING WATER mg/l
0.8
0.6
0.4
0.2
0
CONCENTRATION IN RECEIVING WATER, mg/l
10
8
6
4
2
0
CITY OF ANTIOCH
BENICIA BRIDGE
CARQUINEZ BRIDGE
RICHMOND BRIDGE
BAY BRIDGE
SAN MATEO BRIDGE
DUMBARTON BRIDGE
ALVISO SLOUGH
SUISUN BAY
SAN PABLO BAY
SAN FRANCISCO BAY

FIGURE IV-7



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PROJECT COORDINATION PROGRAM
GRANT-FUNDED WASTEWATER MANAGEMENT FACILITIES
SAN FRANCISCO BAY REGION
SAN FRANCISCO, SAN PABLO AND SUISUN BAYS
WATER QUALITY CHANGES: WASTEWATER IN RECEIVING WATER
TRANSPORT PROJECTS ONLY
JULY 31, 1975
0 5 10 15 20
SCALE, MILES
FRACTION OF WASTEWATER IN RECEIVING WATER VOLUME, PERCENT
0
0.5
1.0
1.5
47%
(1975, 1977, 1978)
SCALE DISCONTINUITY
25
20
15
10
5
0
READ LEFT HAND CONCENTRATION SCALE
READ RIGHT HAND CONCENTRATION SCALE
1975, 1977, 1978, (PRESENT)
1979
1980 (FINAL)
1975, 1977, 1978, 1979 (PRESENT)
1975 (TO RIGHT HAND SCALE)
CITY OF ANTIOCH
BENICIA BRIDGE
CARQUINEZ BRIDGE
RICHMOND BRIDGE
BAY BRIDGE
SAN MATEO BRIDGE
DUMBARTON BRIDGE
ALVISO SLOUGH
SUISUN BAY
SAN PABLO BAY
SAN FRANCISCO BAY

FIGURE IV-8

CHAPTER V

PROBLEMS AND PROBLEM SOLUTIONS

Table V-1 summarizes the problems identified in this study and suggests actions to resolve them. Some types of problems can be anticipated for specific projects, for example, those dealing with construction schedules that are apparently too short. Others, such as those which might result from delays in regulatory agency approvals, cannot be anticipated for specific projects and have not been included in the totals for number or cost of projects. Actions to ameliorate these problems have been listed.

The major conclusions to be drawn from the table are as follows:

- The types of potential problems are varied and their resolution requires different actions by different agencies.
- The number and dollar amount of affected projects is significant for each type of problem.
- Public reaction and scheduling problems have the largest dollar value. Solution of public reaction problems is primarily the responsibility of implementing agencies; scheduling problems could probably be better addressed on a regional level.
- There is a significant role for BASSA in problem solution. It will require aggressive action, especially in the area of scheduling, including the coordination of bid dates, the establishment of realistic schedules, and the reconciliation of reasonable schedules with NPDES permit compliance schedules where the two differ.
- The requirements for a federal Environmental Impact Statement have caused significant delays with at least two large projects. The EIS process can be expected to increase the length of a project's planning stage somewhat. However, it is believed that all requirements that will be made for EIS's on individual Bay Area projects have already been set. Except for the two projects noted, these EIS's are moving ahead as part of the planning process. No new or large delays are expected.

TABLE V-1

IMPLEMENTATION PROBLEMS
EXISTING AND ANTICIPATED

TYPE OF PROBLEM	NUMBER OF PROJECTS	PROJECT COSTS* (million $)	ACTIONS TO AMELIORATE PROBLEMS
PUBLIC REACTION . Neighborhood opposition to facility location . Failure to approve bonds . Land acquisition negotiations	9	315	Implementing agency: Aggressive action to inform and accommodate public, including information on consequences of failure to comply with NPDES permits. Anticipation of land acquisition problems. Regional Board: Inclusion of appropriate implementing agency actions in compliance schedules.
INSTITUTIONAL ARRANGEMENTS . Specific interagency agreement not completed . Lead agency not chosen . Form of agreement not chosen	14	130	Implementing agency: Active negotiations to resolve problems, possible adoption of agendized negotiation schedules. Regional Board: Inclusion of agency negotiations on compliance schedules. BASSA: Possible action as arbiter of conflicts.
SCHEDULING . Failure to comply with NPDES permit . Inadequate engineering staff . Grouping of bid dates causing poor bids . Overly optimistic construction schedule	28	650	Implementing agency: Review of schedules in light of this report, possibly with aid of consultants. Early contracting with engineers. Regional/State Boards: Coordination of planning, grants, and regulatory activities. Careful consideration to adjustment of NPDES permit schedules, at least to agree with Boards' grants and planning schedules. BASSA: Coordination of implementing agencies to resolve conflicts among agencies (bid dates, engineering staff) and assist in presentation of common problems to regulatory agencies.

* Several projects are included in more than one problem area.
Costs include total costs of all projects with that type of problem.

TABLE V-1
(continued)

TYPE OF PROBLEM	NUMBER OF PROJECTS	PROJECT COSTS* (million$)	ACTIONS TO AMELIORATE PROBLEMS
PUBLIC AGENCY REQUIRED ACTIONS . Federal EIS required . Approvals of planning and plans and specifications . Awards of grants . Other agency permits required	5**	90	Regional/State Boards: Continue present system of project tracking to anticipate periods of heavy review/award activity.
CONSTRUCTION DELAYS . Strikes . Late delivery of equipment . Material and labor shortages	4**	110	Implementing agency: Consider pre-purchase of major equipment. State Board: Consider accommodating pre-purchase in grant process. BASSA: Coordinate implementation agencies to solve common problems.
MISCELLANEOUS . No market for reclaimed water . Not on state project list . Deferment for regional study	3	75	BASSA: Assist implementing agencies in anticipating and resolving problems.

* Several projects are included in more than one problem area.
Costs include total costs of all projects with that type of problem.

** Includes only existing delays.